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NATIONAL DAM INSPECTION PROGRAM. UNIVERSITY OF MARYLAND BALTIMO--ETC(U)
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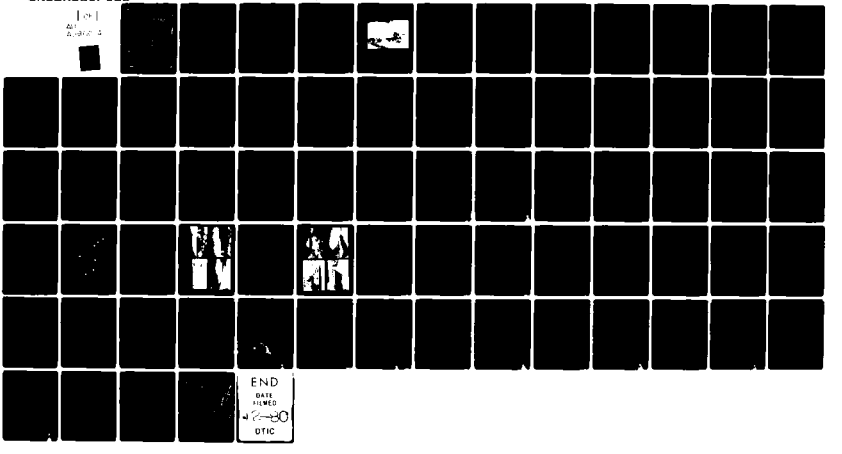

CHESAPEAKE BAY BASIN
WEST BRANCH OF HERBERT RUN
BALTIMORE COUNTY

MARYLAND. LEVEL

NDI ID NO. MD 34

National Dam Inspection Program

UNIVERSITY OF MARYLAND
BALTIMORE COUNTY
DAM (NDI-ID Number MD34)

PHASE I INSPECTION REPORT
~~NATIONAL DAM INSPECTION PROGRAM~~

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James D. Hainley
Timothy E. Dukes

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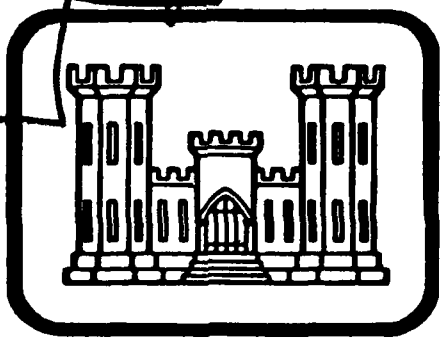

PREPARED FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND 21203

DACW31-80-C-0026

ACKENHEIL & ASSOCIATES, BALTIMORE, MD., INC.
7902 BELAIR ROAD
BALTIMORE, MARYLAND 21236

AUGUST 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase 1 investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase 1 investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigation and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase 1 investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase 1 inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" (PMF) for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS

NAME OF DAM:	University of Maryland Baltimore County Dam
STATE LOCATED:	Maryland
COUNTY LOCATED:	Baltimore
STREAM:	West Branch of Herbert Run, a tributary of the Patapsco River
DATES OF INSPECTIONS:	May 15, 1980 and July 31, 1980
COORDINATES:	Lat. 76°, 42.2'; Long. 39° 15.7'

ASSESSMENT

UMBC Dam is classified as a "small" size, "high" hazard dam in accordance with U. S. Army Corps of Engineers dam safety critera.

Based on the evaluation of available design information and visual observations of conditions as they existed on the dates of the field reconnaissances, the general condition of UMBC Dam is considered to be good. However, the accumulated debris and sediment obstructing the principal spillway entrance structure is considered to represent a potential hazard to the dam. Immediate removal of the debris and sediment and construction of an improved trash rack(s) or cage is advised. The presence of surface erosion on the embankment-spillway abutment and around the impact stilling basin, and tree and woody shrub growth located along the embankment-spillway abutment, downstream slope and exit channel, are considered minor deficiencies in need of maintenance.

Guideline criteria recommends spillway design floods from 0.5 PMF to the PMF for "small" size, "high" hazard dams. Based on the observed downstream hazard, a PMF spillway design flood is considered appropriate for UMBC Dam. Review of available hydrologic/hydraulic design calculations indicate the emergency spillway can pass the PMF without overtopping the dam embankment. Therefore, spillway capacity is assessed adequate in accordance with recommended guideline criteria.

RECOMMENDATIONS

The following recommendations should be implemented as soon as possible:

1. Develop and institute a flood surveillance, warning, and evacuation plan.

2. Remove accumulated debris and sediment from impoundment basin and trash rack, and downstream exit channel.

3. Replace the existing damaged trash rack with a larger and more durable one.

4. Remove tree and woody shrub growth from upstream embankment-spillway abutment.

5. Install anchor bolts and secure principal spillway access ladder to riser wall.

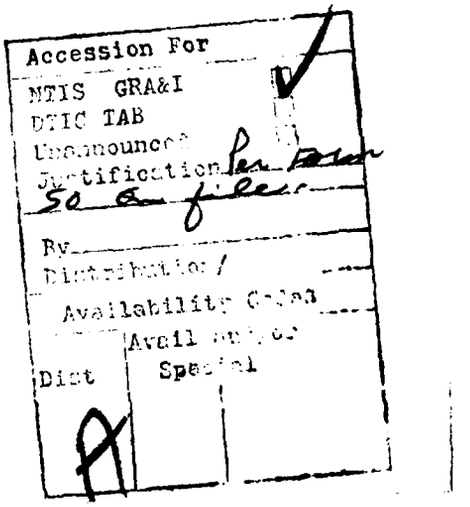
6. Periodically observe areas where wet zones were encountered. Note any change in condition and ascertain cause of intermittent ponded water.

7. Repair protective screen fence at impact stilling basin.

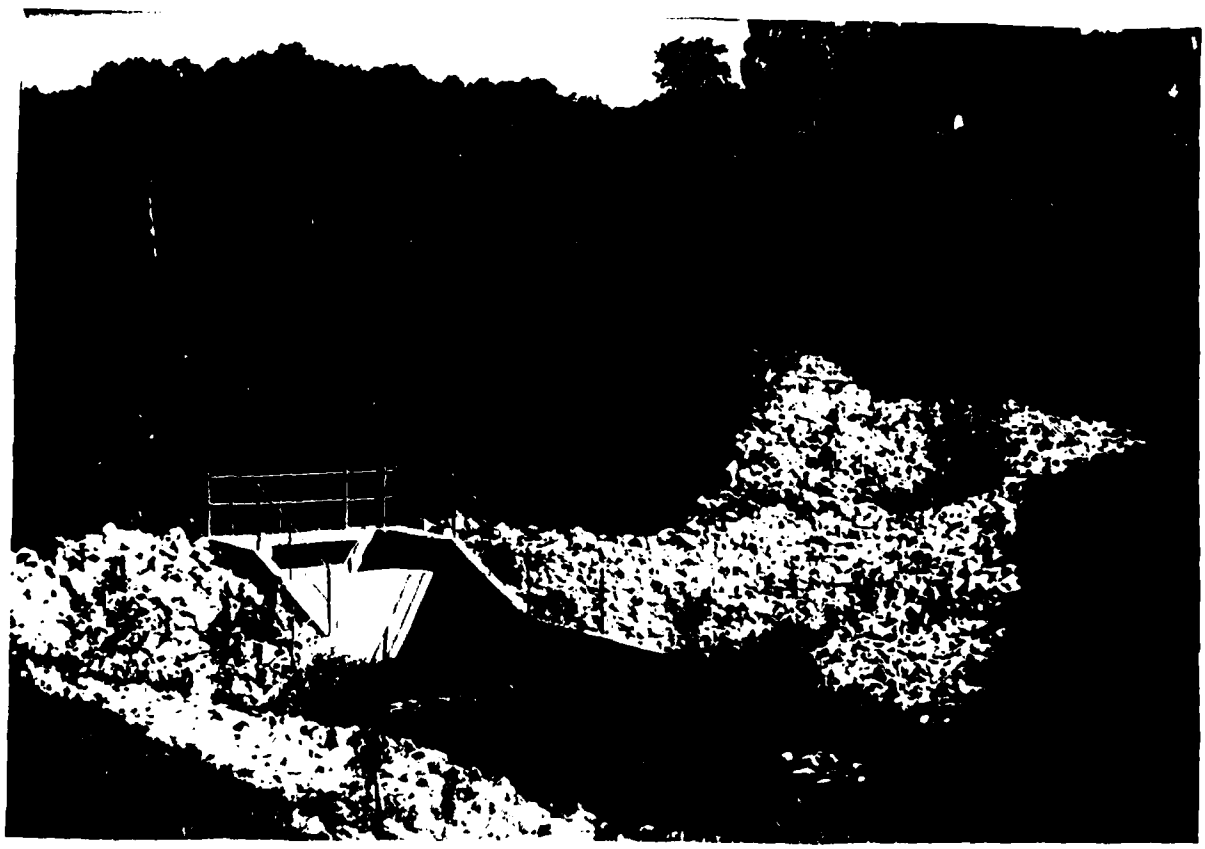
James D. Hainley, P.E. Date
Maryland Registration No. 5284
Vice President

Timothy E. Debes, P.E. Date
Maryland Registration No. 12020
Project Engineer

APPROVED BY: 18 Sep 80
Date
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer



UNIVERSITY OF MARYLAND
BALTIMORE COUNTY
DAM



Overview of Dam

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NATIONAL DAM INSPECTION PROGRAM
UNIVERSITY OF MARYLAND
BALTIMORE COUNTY
DAM
NDI ID. NO. MD 34

SECTION 1
PROJECT INFORMATION

1.1 GENERAL

A. AUTHORITY: This study was performed pursuant to the authority granted by the National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

B. PURPOSE: The purpose of this study is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

A. DAM AND APPURTENANCES

1. Embankment: The UMBC Dam was constructed as a zoned earthfill structure. The dam is approximately 255 ft. long, with a maximum toe to crest height of 41 ft. and a crest width of 20 ft. The upstream embankment slope has an inclination of 3H:1V. The downstream embankment slope has inclinations of approximately 20H:1V from the embankment toe to 26 ft. below the dam crest and 3H:1V from this point to the dam crest. Riprap protection is provided on the downstream embankment-spillway abutment.

2. Seepage Control Provisions: According to design drawings, seepage control is provided by a cutoff trench and a filter drain. The cutoff trench is located at the dam centerline and is continuous with the embankment core. Seepage is collected by a filter drain located along the side walls of the impact stilling basin. The collected seepage is discharged into the downstream channel by outlet pipes exiting through the impact stilling basin side walls.

3. Flood Discharge Facilities: Flood discharge facilities consist of a principal spillway outlet pipe and an emergency spillway channel.

   The principal spillway consists of a reinforced concrete entrance structure, a 259 ft. long 72 in. dia. reinforced concrete outlet pipe and a reinforced concrete impact stilling basin.

   The emergency spillway channel is excavated into natural earth and is located at the left abutment. The spillway channel is approximately 150 ft. wide with a 30 ft. long level control section at the dam centerline.

B. LOCATION: The UMBC Dam is situated across the west branch of Herbert Run. The dam is located on the UMBC campus approximately 0.5 miles northwest of Arbutus, Maryland in Baltimore County.

C. SIZE CLASSIFICATION: The dam has a maximum temporary storage capacity of 185 ac.-ft. and a toe to crest height of 41 ft. Based on this criteria, the dam is classified as a "small" size structure.

D. HAZARD CLASSIFICATION: The UMBC Dam is classified as a "high" hazard structure. In the event of a dam failure, more than 25 inhabited structures are expected to be subject to substantial damage and loss of life along an approximate 3.5 mile channel reach of Herbert Run from the dam to the Patapsco River.

E. OWNERSHIP: UMBC Dam is owned by the University of Maryland, College Park, Maryland 20742. All correspondence concerning the maintenance and operation of the dam should be directed to Leon Herring, Director, Physical Plant Department, University of Maryland, Baltimore County, 5401 Wilkins Avenue, Catonsville, Maryland 21228. Inquiries concerning the safety operation of the dam should be directed to Robert Schirmer, Safety Engineer, Department of Public Safety.

F. PURPOSE OF DAM: UMBC Dam was constructed for use as a flood control structure.

G. DESIGN AND CONSTRUCTION HISTORY: The dam was designed by Rummel, Klepper & Kahl, Consulting Engineers, Baltimore, Maryland with the assistance of the Soil Conservation Service. The dam was constructed by Harry T. Campbell & Sons Co. under the supervision of the State of Maryland, Department of General Services and the design engineer. Construction of the dam took place between June 1975 and September 1976.

H. NORMAL OPERATING PROCEDURES: Under normal operating conditions, normal stream base flow is discharged through the principal spillway pipe.

1.3 PERTINENT DATA

A. DRAINAGE AREA	1.2 sq. mi.
B. DISCHARGE AT DAM FACILITY	
Maximum known flood at dam facility	Unknown
Maximum spillway capacity at El. 175.0, 3 ft. below top of dam	11,700 cfs
C. ELEVATION (FEET ABOVE MSL)	
Constructed top of dam	El. 178.0
Design high water	El. 175.0
Normal pool	None

C. ELEVATION (FEET ABOVE MSL, CONT.)

Emergency spillway crest	El. 166.5
Maximum tailwater	Unknown
Upstream invert of principal spillway pipe	El. 139.5
Downstream invert of principal spillway pipe	El. 136.9
Streambed at dam centerline	El. 140+
Downstream toe of dam	El. 137+

D. RESERVOIR LENGTH

Length of maximum pool	1,733 ft.
Length of normal pool	N/A

E. STORAGE CAPACITY

Constructed top of dam	185 ac.-ft.
Emergency spillway crest level	90 ac.-ft.

F. RESERVOIR SURFACE

Constructed top of dam	12 acres
Emergency spillway crest level	10 acres

G. DAM EMBANKMENT

Type	Earthfill
Length	255 ft.
Height	41 ft.
Top width	20 ft.
Side slopes	
Downstream	3H:1V from dam crest to 26 ft. below crest, 20H:1V from 26 ft. below dam crest to embankment toe
Upstream	3H:1V
Zoning	Yes
Impervious core	Yes
Cutoff provisions	Cutoff trench
Grout curtain	No

H. EMERGENCY SPILLWAY CHANNEL

Type	Trapezoidal earth channel
Width	150 ft.
Crest elevation	166.5 ft.
Gate	None
Upstream channel	Vegetated earth with a negative 2 percent slope
Control crest length	30 ft.
Downstream channel	Vegetated earth with a positive 2 percent slope
Length of channels	694 ft., curved

SECTION 2
ENGINEERING DATA

2.1 DESIGN

A. DATA AVAILABLE: The following available data may be obtained from the Dam Safety Division, Maryland Water Resources Administration.

1. Hydrology and Hydraulics: Available information includes a statistical data sheet, Peak Discharge versus Storm Recurrence Interval Plot, 25 yr. and 50 yr. flood plain delineation maps, Drainage Study, West Branch of Herbert Run prepared by Van-Reuth & Weidner, Inc., 6 hr. 100 yr. and PMP hydrological calculations and flood hydrographs, stage-storage and stage-area curves, reservoir routing calculations, and a dam breach analysis.

2. Embankment: Design information includes construction drawings, an environmental impact statement on proposed construction, geological investigation summary, laboratory test data, stability analysis, and drilling and test pit logs. Information included in Geotechnical Investigation and Design Recommendations for a Proposed Impoundment at The University of Maryland, Baltimore County Campus, dated June 1974. Report is available from Rummel, Klepper & Kahl.

3. Appurtenant Structures: Design information is limited to construction drawings and principal spillway pipe design calculations.

B. DESIGN FEATURES: Dam and appurtenances were designed in accordance with Soil Conservation Service structure classification "C" criteria ("high" hazard).

1. Embankment: The zoned earthfill dam structure consists of a semi-impervious core, and upstream and downstream embankment shells. The embankment core extends from the cutoff trench to 12 ft. below the dam crest. Core side slopes taper on a 2H:1.5V inclination from a 34 ft. wide base to a top width of 10 ft. Select borrow, obtained from excavation of the impoundment basin and left side slope, was used to construct the embankment shells and core.

   A two (2) ft. thick blanket of riprap was placed around the principal spillway entrance structure and impact stilling basin on the upstream and downstream embankment slopes respectively.

2. Seepage Control Provisions: According to design drawings, the earthfill cutoff trench was constructed as a continuation of the embankment core. The cutoff trench has a base

width of 20 ft., increasing to a top width of 60 ft., with 1H:1.5V side slopes. Select borrow, obtained from sources identified above, was used to backfill the trench excavation.

A filter drain was installed around the side walls of the impact stilling basin. The drain consists of a 6 in. dia. perforated pipe imbedded in coarse filter material, protected by a 1 foot thick blanket of fine filter material. Drain outlets are located at the end of each impact stilling basin wing wall.

Three (3) anti-seep collars were installed around the principal spillway outlet pipe. Anti-seep collars were located at impoundment base line Stations 19+55, 19+75 and 19+95.

3. Flood Discharge Facilities: The 72 in. dia. principal spillway outlet pipe is supported by a continuous concrete cradle. The outlet pipe end section is supported and connected to the reinforced concrete inlet wall of the impact stilling basin. Outlet pipe flow is discharged into the basin baffle block, through the basin outlets and into the exit stream channel.

   The emergency spillway is trapezoidal in shape with right and left side slope inclinations of 3H:1V and 2.5H:1V, respectively. The overall length of the curved spillway crest and channels is 694 ft. The upstream spillway channel is approximately 370 ft. long with a negative 2.0 percent slope. The downstream spillway channel is approximately 304 ft. long with a positive 2.0 percent slope. The right side slopes of the spillway channel and the exit stream channel are lined with a (two) 2 ft. thick blanket of riprap. Spillway flows are discharged directly into the downstream channel approximately 250 ft. downstream of the dam centerline.

2.2 CONSTRUCTION: Based on review of available design drawings and field observations, it may be concluded that the dam and appurtenances were constructed in general accordance with the intended design drawings.

2.3 OPERATION: The UMBC dam is an uncontrolled, storm water management facility. The University of Maryland, Baltimore County Campus is responsible for maintaining the principal spillway pipe and emergency spillway channel.

2.4 EVALUATION

A. AVAILABILITY: Available design drawings and information were obtained from the Dam Safety Division, Maryland Water Resources Administration and Rummel, Klepper & Kahl.

B. ADEQUACY: The design data provided is reasonably documented and is considered adequate to evaluate the dam and appurtenant structures in accordance with the scope of a Phase 1 study.

Based on the review of this data, the dam and appurtenant structures are considered to have been designed in general conformance with accepted engineering practice.

C. VALIDITY: Based on the available data, there is no reason to question the validity of the obtained design information or drawings.

SECTION 3
VISUAL INSPECTION

3.1 FINDINGS

A. GENERAL: The on-site reconnaissance of UMBC Dam consisted of:

1. Visual observations of the earth embankment, abutments, and spillway channel.

2. Visual observations of exposed sections of the principal spillway pipe, impact stilling basin, impoundment basin and slopes, and downstream channel.

3. Visual search for hazardous conditions and safety deficiencies.

4. Evaluation of the downstream hazard potential.

5. Transit stadia survey of relative elevations along the embankment crest centerline, spillway, and across the embankment slopes.

Visual surveys were performed during periods when there was no water impounded behind the dam structure.

A visual observation check list and field sketch are given in Appendix A. Specific observations are illustrated in photographs of Appendix C.

B. EMBANKMENT: Embankment slopes had field measured inclinations approximating 3H:1V and a crest width of 20 ft. Embankment crest and slopes had a dense grass covering and appeared stable. Trees and woody shrubs were located along the embankment-spillway abutment, extending from dam centerline to the impact stilling basin. Eroded tire ruts were observed along the dam crest, bottom of the spillway channel, and embankment-spillway abutment (see field sketch).

C. APPURTENANT STRUCTURES

1. Principal Spillway: The principal spillway entrance structure trash rack was severely obstructed by wood, debris, and sediment. Trash rack cross members were badly damaged and twisted.

   Exposed concrete surfaces were observed free of spalling and cracking, and appeared in good condition.

2. Impact Stilling Basin: The concrete stilling basin appeared to be in good structural condition. Shallow soil erosion was evident along the upstream sidewall. Stilling basin and baffle block discharge section were observed free of debris and flow obstructions.

The 6 in. dia. perforated pipe outlets could not be located underneath the riprap protection. However, no drainage was discernible near the stilling basin wing walls where the pipe outlets are supposedly located. Tree growth and sediment has accumulated in the exit channel directly downstream of the stilling basin.

3. Emergency Spillway: Spillway channel bottoms and side slopes are vegetated with a dense grass and appear stable. The right downstream channel side slope has riprap extending from the channel bottom to about 6 ft. below the dam crest. Left and right spillway side slopes have field measured inclinations of 2.5H:1V and 3H:1V respectively.

D. IMPOUNDMENT BASIN: Impoundment basin side slopes have moderate to steep inclinations and are well covered with vegetation and trees. Appreciable quantities of debris and sediment have accumulated in the impoundment basin and approach channel within approximately 200 ft. upstream of the entrance structure.

E. DOWNSTREAM CHANNEL: The immediate downstream channel reach is about 10 ft. wide and has stable side slopes. Channel side slopes and banks are lined with grass, trees and thick brush cover. No conditions were observed in the downstream channel that might cause significant flow obstruction and present hazard to the dam.

Downstream from the dam, the west branch of Herbert Run flows approximately 3 miles south to its confluence with the Patapsco River. The communities of Arbutus and Cowdensville are respectively located approximately 0.5 and 1 mile downstream of the dam. In the event of a dam failure, more than 25 inhabited structures are expected to be subject to substantial damage and loss of life.

3.2 EVALUATION

A. EMBANKMENT: In general, the dam embankment is adequately maintained and appears in good condition. The eroded tire ruts, observed on the embankment-spillway abutment, are considered surficial deficiencies in need of maintenance. Trees and woody shrubs located along the embankment-spillway abutment will require removal.

B. APPURTENANT STRUCTURES: Accumulated debris and sediment, obstructing the entrance structure and encroaching upon the downstream channel, should be removed and disposed of properly. The entrance structure trash rack should be removed and a larger and more durable trash rack provided.

In general, the spillway channel, principal spillway pipe and impact stilling basin appear to be in good condition.

SECTION 4
OPERATIONAL FEATURES

4.1 PROCEDURE: The dam was designed as an uncontrolled structure and impounds water only during flood conditions. The emergency spillway is ungated and does not require a dam tender.

4.2 MAINTENANCE OF DAM: The dam embankment and appurtenant structures are maintained by the UMBC Physical Plant Department. Normal maintenance includes periodically mowing the embankment slope and emergency spillway channel and clearing the impoundment basin and trash rack of debris and sediment.

4.3 INSPECTION OF DAM: The dam is inspected by the UMBC Physical Plant Department periodically and after significant storms. UMBC campus police monitor the dam during periods of unusually heavy rainfall. Inspections generally consist of visually examining the embankment and appurtenant structures and providing repair recommendations.

4.4 MAINTENANCE OF OPERATING FACILITIES: There are no operational facilities at the dam.

4.5 WARNING SYSTEM: The UMBC, Department of Public Safety, directed by the Safety Engineer would alert Baltimore County Police, Maryland State Police, and Civil Defense authorities in the event the emergency spillway was activated. However, there is no formal flood warning plan presently in effect.

4.6 EVALUATION: Except for the condition of the approach channel and entrance structure trash rack, and the lack of a formal warning system, the maintenance and operational procedures in effect at the dam are considered adequate. However, a formal flood surveillance, warning and evacuation plan is needed for the protection of downstream inhabitants. Also, a more thorough maintenance program is needed to regularly remove collected debris and sediment from the principal spillway entrance structure.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. DESIGN DATA: UMBC Dam has a watershed drainage area of 750 acres vegetated primarily by grassland (65%) and woodland (15%) with some urban development (20%). Topographic relief ranges from El. 136 to El. 480. Hydrologic analyses were based on Soil Conservation Service structure classification "C" criteria ("high" hazard).

The principal spillway pipe was sized to pass the runoff resulting from a 100 yr., 6 hr. storm without activating the emergency spillway. Estimated maximum pipe outflow is 700 cfs. Expected pool elevation for the 100 yr. storm is 166.5 ft., the level of the emergency spillway control crest.

The hydraulic capacity of the emergency spillway channel is reported to be 11,700 cfs when impounded storm water is at El. 175.0, three (3) ft. below dam crest. Spillway capacity was designed to pass a flood corresponding to 24.2 in. of runoff in 6 hours without overtopping the dam embankment.

According to guideline criteria, "small" size, "high" hazard dams have recommended spillway design floods ranging from 0.5 PMF to the PMF. Based on the downstream hazard potential a PMF spillway design flood is considered appropriate for the dam facility. Routing calculations reviewed by this study indicate dam storage and emergency spillway discharge capacity are adequate to pass 100 percent of the PMF.

The reviewed hydrologic/hydraulic design information is in accordance with accepted engineering practice and is considered to be adequate for the scope of a Phase 1 study.

B. EXPERIENCED DATA: Records are not kept of water impoundment elevations or rainfall amounts. There is no record or report of the emergency spillway ever being activated.

C. VISUAL OBSERVATIONS: The principal spillway entrance structure was severely obstructed by debris and sediment. Such an obstruction is undesirable and may pose a potential hazard to the dam. Accumulated sediment was also found deposited directly downstream of the impact stilling basin. Although these sediment deposits are not considered to represent a significant hazard at this time, immediate removal of the sediment and debris at both the entrance structure and stilling basin is recommended. Tree and woody shrub growth along the embankment-spillway abutment may affect spillway hydraulic performance and should be removed.

D. OVERTOPPING POTENTIAL: Hydrometeorological Report No. 33 indicates the adjusted 6 hr. PMF direct rainfall for the subject site area is 21.7 in. Routing calculations indicate dam storage and emergency spillway discharge capacity is adequate to pass a flood corresponding to 24.2 in. of runoff in 6 hrs. without overtopping the dam crest. Based on this data, it is considered unlikely the dam embankment will be overtopped.

E. EMERGENCY SPILLWAY ADEQUACY: The data previously developed indicates that impoundment storage and spillway hydraulic capacity is adequate to pass 100 percent of the PMF. The dam and spillway are therefore considered adequate and in accordance with recommended criteria.

F. DOWNSTREAM CONDITIONS: Downstream of the dam, Herbert Run empties into the Patapsco River directly south of Relay, Maryland. In this approximate 3 mile channel reach and estimated flood plain, more than 25 inhabited structures are expected to be subject to substantial damage and loss of life in the event of a dam failure.

Herbert Run has a natural channel gradient of about 1.0 percent, and underpasses ten state and county bridges before merging with the Patapsco River.

SECTION 6
STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. VISUAL OBSERVATIONS

1. Embankment: Embankment deficiencies identified in Section 3.1-B are not considered to have a significant affect on dam stability. In general, the structural condition of the embankment slopes is assessed as good at the present time.

2. Appurtenant Structures: Visual observation of the spillway channel did not reveal evidence of structural distress that would significantly affect dam stability. However, the debris and sediment obstructing the entrance structure should be immediately removed to reduce the risk of clogging during a flood.

B. DESIGN AND CONSTRUCTION DATA

1. Subsurface Exploration: Design drawings indicate 16 auger borings and 25 standard test borings were drilled in the vicinity of the proposed dam site and upstream and downstream channels. In addition, 13 test pits were excavated in the same general area. Test boring and test pit logs indicate the predominant presence of silt, clay, and sand soil mixtures between 0 and 8 ft. below ground surface. Below 4 to 8 ft., a cobble and gravel layer, mixed with silt and clay was encountered.

2. Slope Stability Analysis: Slope stability of upstream and downstream embankment slopes was evaluated using a computer circular arc method. The analysis considered a 40 ft. high zoned earthfill embankment with 3H:1V side slopes. Analyses were based on the dam cross section at the location of the principle spillway pipeline. Critical factor of safety values against shear failure of 3.18 and 1.44 were obtained for steady state seepage conditions of the downstream slope and normal pool conditions for the upstream slope, respectively.

3. Seepage Analysis: No calculations or references were found.

4. Laboratory Testing: Classification, compacted dry density and shear strength tests were performed on selected samples of foundation and proposed borrow soils. Soil samples were obtained by split spoon samplers and from test pit excavations.

   Results of classification tests indicate GM, SC, SM, CH, and CL-ML soils are predominant at the dam site. Consolidated quick direct shear tests were performed to estimate the

shear strength of compacted borrow soils. Test results indicate shear strength values of ϕ = 11°, c = 2,400 psf, and ϕ = 25°, c = 1,200 psf for clay and general excavation soils.

5. Appurtenant Structures: The available principal spillway entrance structure, pipe, and impact stilling basin design drawings and calculations, were reviewed for structural adequacy. Based upon this review and reported performance history, these structures are considered structurally adequate with the exception of the entrance structure trash rack.

C. OPERATING RECORDS: Operating records are not maintained.

D. POST-CONSTRUCTION CHANGES: There have been no reports or evidence of post-construction changes at this dam facility.

E. SEISMIC STABILITY: Based on visual observations, review of static slope stability analyses, and the past performance history of the dam, the static stability of the embankment slopes is considered to be adequate.

According to guideline criteria, the dam is located in a Seismic Zone 1 area (low seismic probability). Based upon this low seismic probability, the static stability of the dam, and the recommended criteria for evaluating the seismic stability of dams, the seismic stability of the dam is presumed to be adequate.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. EVALUATION

1. Embankment: The observed deficiencies presented in Section 3.1-A are surficial in scope and are not considered to represent a hazard to the dam at this time. However, necessary repairs or corrections should be made. In general, visual observations indicate the dam embankment crest and slopes are adequately maintained and in good condition.

2. Appurtenant Structures: Accumulated debris and sediment, obstructing the entrance structure and encroaching upon the downstream channel, should be removed and disposed of properly. The entrance structure trash rack should be removed and a larger and more durable one provided.

   In general, the principal spillway entrance structure and impact stilling basin are assessed in fair and good condition respectively.

3. Overtopping Potential: U.S. Army Corps of Engineers dam safety criteria recommends a spillway design flood ranging from 0.5 PMF to the PMF. Based on the observed downstream hazard, a PMF design flood is considered appropriate for UMBC Dam. Hydrologic/hydraulic calculations reviewed by this study indicate the dam can pass 100 percent of the PMF without overtopping the dam.

4. Spillway Adequacy: Based on the data presented above and routing calculations, emergency spillway capacity is assessed adequate and in accordance with recommended dam safety criteria.

B. ADEQUACY OF INFORMATION: The design drawings and hydrologic/hydraulic design data available for this review were of sufficient detail to adequately conduct a Phase 1 study.

C. NECESSITY FOR FURTHER INVESTIGATION: The owner should develop methods to reduce the quantity of trash and debris that frequently collects on, and obstructs the principal spillway entrance structure and trash rack.

D. URGENCY: Although no urgency exists for instituting the remedial measures recommended, these measures should be accomplished as soon as possible.

7.2 RECOMMENDATIONS: The following recommendations are presented based on the data obtained:

A. DAM AND APPURTENANT STRUCTURES

1. Remove accumulated debris and sediment from impoundment basin and trash rack, and the downstream exit channel.

2. Replace the existing damaged trash rack with a larger and more durable one.

3. Develop methods of reducing the quantity of trash and debris that frequently collects on, and obstructs the principal spillway entrance structure and trash rack.

4. Repair and seed surface erosion along the embankment-spillway abutment.

5. Remove tree and woody shrub growth located along embankment-spillway abutment, downstream embankment slope, and exit channel side slopes.

B. OPERATION AND MAINTENANCE PROCEDURES

1. Develop a formal flood surveillance and warning plan. Plan to include, but not limited to, the following:

a) Surveillance: Around-the-clock surveillance of spillway channel discharge during periods of unusually heavy rainfall.

b) Warning System: Formal warning procedures to alert downstream residents in the event or threat of a dam failure.

c) Evacuation Plans: Adequate emergency contingency plans to evacuate downstream residents in the event or threat of a dam failure.

2. Develop a more thorough maintenance program to regularly remove collected debris and sediment from the principal spillway entrance structure.

APPENDIX A

VISUAL OBSERVATIONS CHECK LIST AND FIELD SKETCH

VISUAL OBSERVATION CHECK LIST

Name Dam University of Maryland Baltimore County Dam County Baltimore State MD National ID # MD 34

Type of Dam Earthfill Hazard Category Class I - High Hazard

Date(s) Inspection 5/15/80 Weather Clear Temperature 65°

Inspection Review Date 7/31/80

Pool Elevation at Time of Inspection None* Tailwater at Time of Inspection Normal M.S.L.

Inspection Personnel:

Ackenheil & Associates
Paul D'Amato
Timothy Debes
Richard Gabell
James Hainley

U.M.B.C.
Jack Harmon

Recorder Paul D'Amato

*Flood control only, no permanent pool.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS*
SURFACE CRACKS	None observed. Embankment crest and slopes vegetated with a dense grass covering.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Eroded tire ruts on left embankment-spillway abutment. Also, surface erosion along impact stilling basin side walls.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No significant vertical or horizontal misalignment observed.	
RIPRAP FAILURES	Riprap protection observed in good condition. Tree and woody shrub growth located along riprap covered downstream channel and embankment-spillway abutment.	

*REFER TO REPORT SECTIONS 3 AND 7

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SETTLEMENT	None observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junctions are generally in good condition, however, downstream embankment-spillway junction observed to have some small tree growth.	
ANY NOTICEABLE SEEPAGE	None. Embankment was not subject to impoundment conditions during field reconnaissance.	
STAFF GAGE AND RECORDER	None.	
DRAINS	Outlets, for 6 in. dia. perforated drain pipes, located adjacent to impact stilling basin wing walls could not be found under rock riprap.	

OUTLET WORKS

(Pond Drain)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Exposed concrete surfaces observed in good condition. No evidence of significant spalling or cracking was found.	
INLET STRUCTURE	Inlet structure trash rack severely damaged and partially obstructed with wood debris and sediment. Concrete head and wing walls observed in good condition. Approach channel and impoundment basin filled with sediment and debris, extending approximately 200 ft. upstream of dam.	
OUTLET STRUCTURE	Concrete impact basin observed in good condition. Exposed concrete surfaces found free of significant cracking and spalling.	
OUTLET CHANNEL	Outlet channel side slopes are lined with riprap, extending approximately 45 ft. downstream of the impact stilling basin. Downstream channel banks are vegetated with grass and appear stable.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None.	
APPROACH CHANNEL	Spillway approach channel and control crest vegetated by a dense grass cover. Channel observed free of debris and flow obstructions.	
DISCHARGE CHANNEL	Discharge channel vegetated with a dense grass cover and observed free of flow obstructions.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

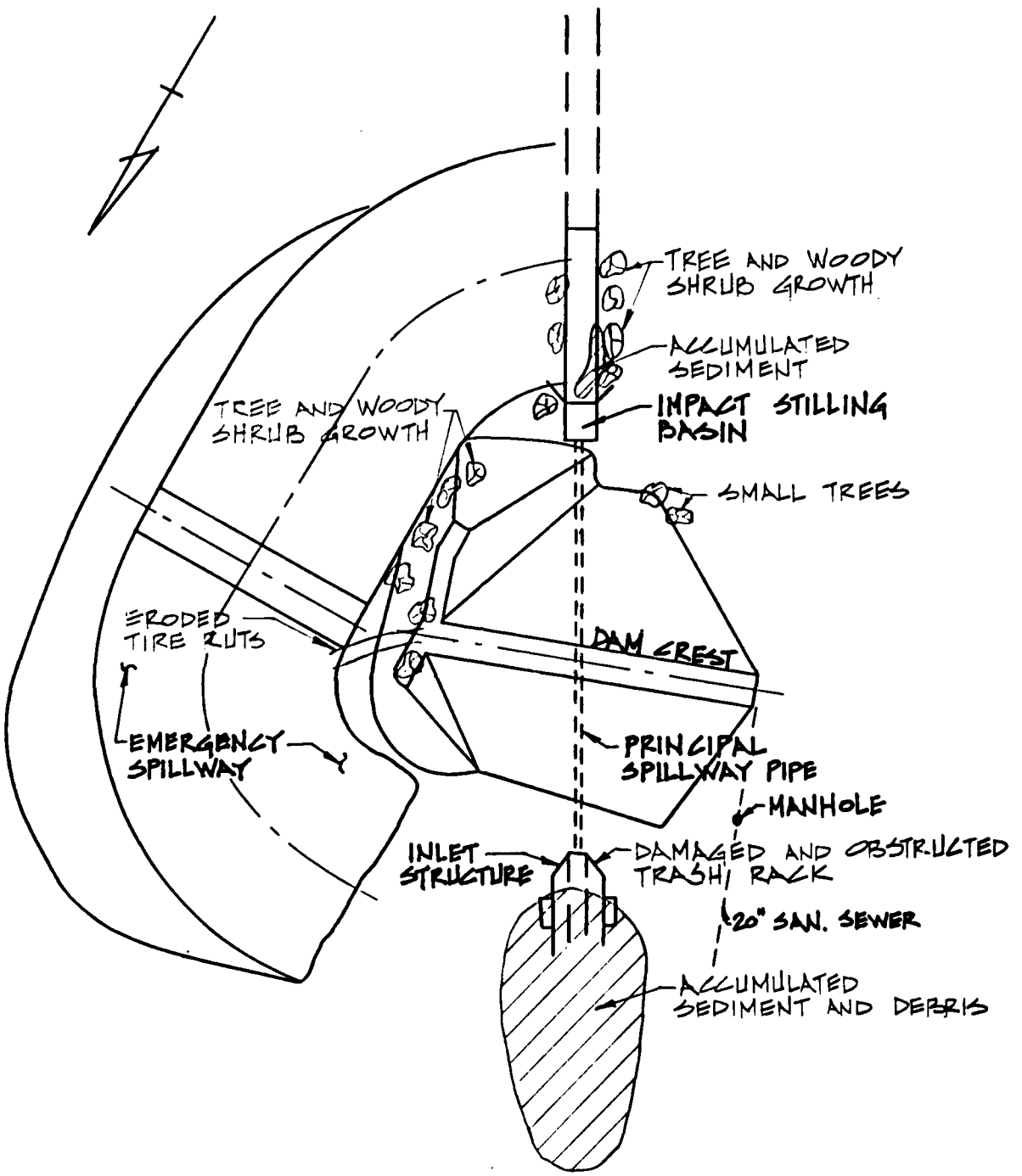
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	N/A	

RESERVOIR

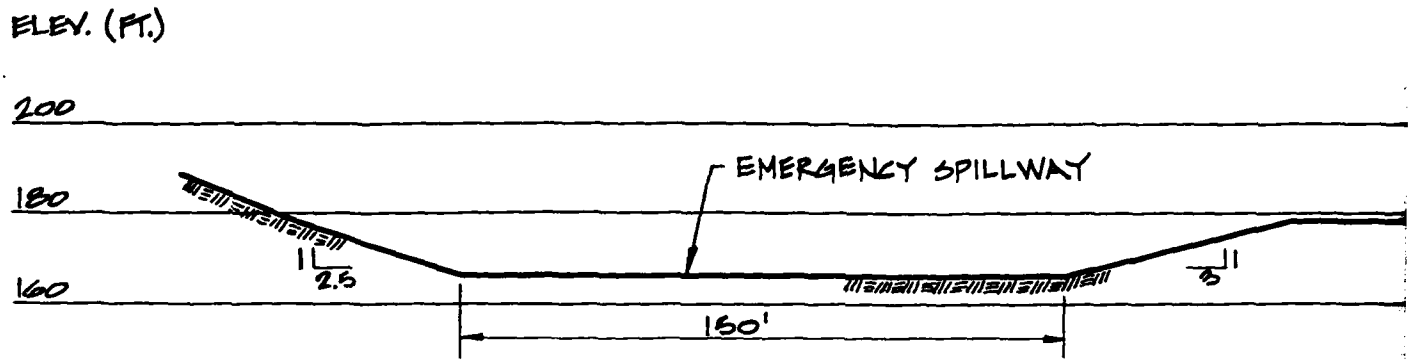
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Impoundment basin slopes have moderate to steep inclinations, are well vegetated and appear stable. No evidence of landslides, embankment sloughing or significant erosion was observed.	
SEDIMENTATION	Sediment observed deposited in impoundment basin and stream channel located upstream of inlet structure.	

DOWNSTREAM CHANNEL

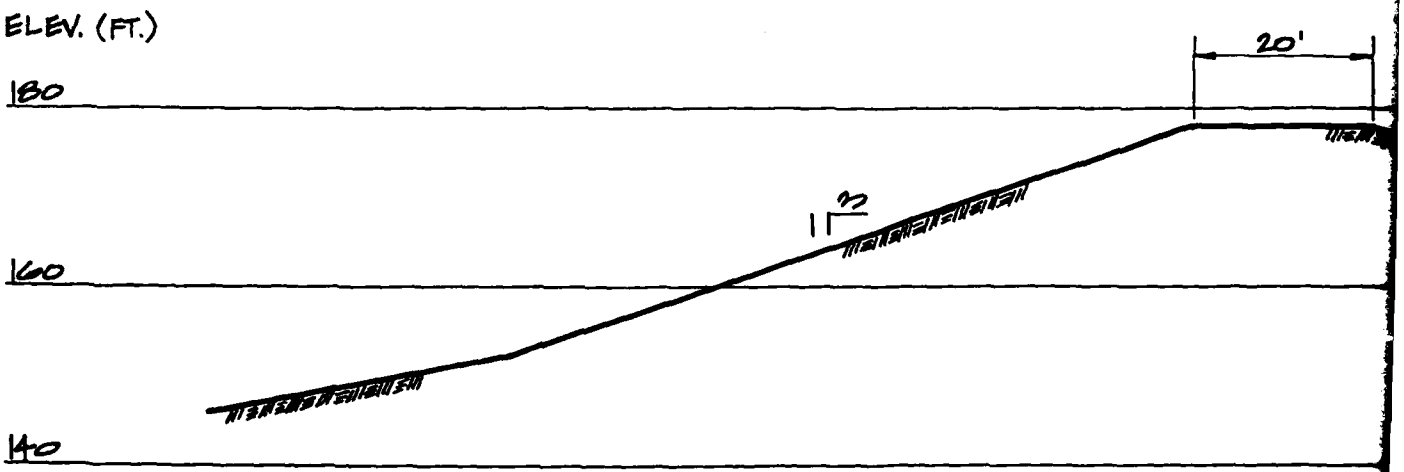
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Several tree saplings are located within 30 ft. of the impact stilling basin and along the downstream channel. Deposits of accumulated sediment are located just downstream of the impact stilling basin.	
SLOPES	Channel side slopes appeared stable. The left channel bank was vegetated with grass, whereas, the right channel bank was lined with riprap.	
APPROXIMATE NO. OF HOMES AND POPULATION	It is estimated that there are more than 25 inhabited structures located within the estimated downstream flood plain between the dam site and the point of confluence with the Patapsco River.	



DATE: AUG. 8, 1980	NATIONAL DAM INSPECTION PROGRAM	U.M.B.C. DAM FIELD SKETCH
SCALE: NONE		
DR: JLM CK: TED	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD.	
DWG. NO. A-10		

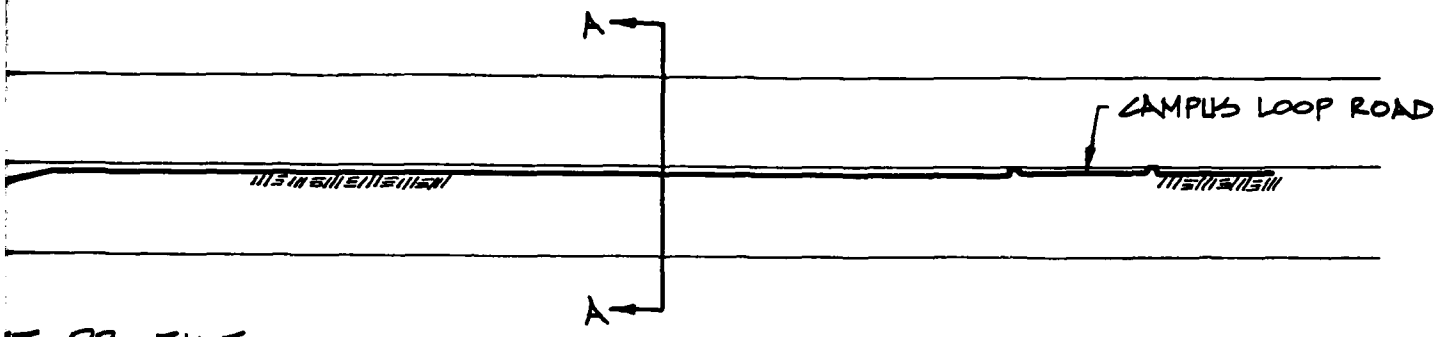


DAM CREST PRO
1"=40

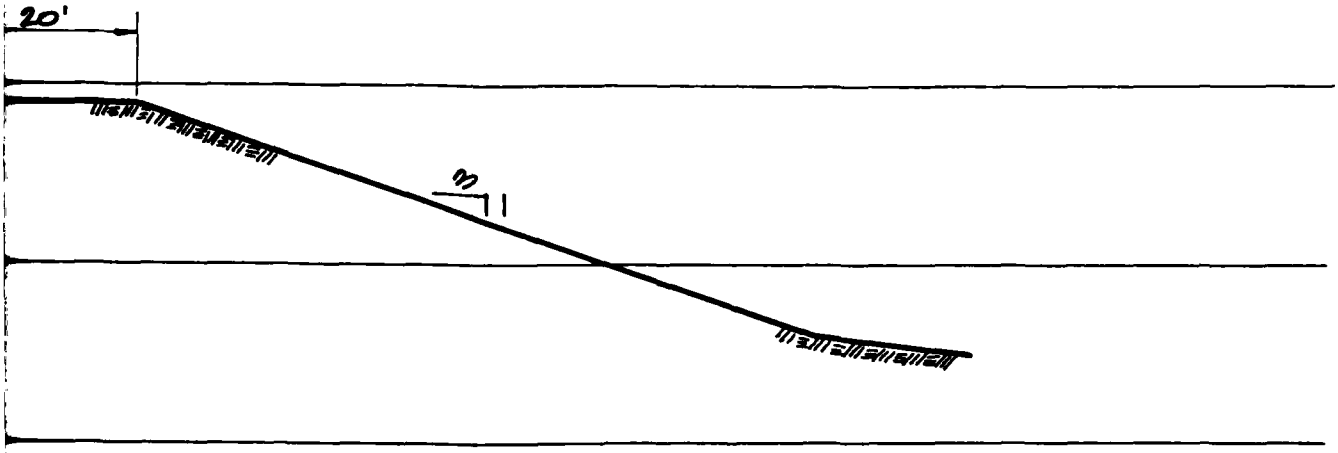


TYPICAL SECTION
1"=20'

NOTE:
ASSUMED DATUM ELEV. 178.0
TOP OF DAM @ SECTION A-A



ST PROFILE



CTION A-A THRU DAM

DATE: AUG. 8, 1980	NATIONAL DAM INSPECTION PROGRAM	U.M.B.C. DAM
SCALE: AS SHOWN		
DR: JLM CK: GRG	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD	
DWG. NO. A-11		

APPENDIX B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

NAME OF DAM: University of Maryland Baltimore County Dam

ID #: MD 34

ITEM	REMARKS
AS-BUILT DRAWINGS	As-built drawings were not available. Design drawings were provided by the Maryland, Water Resources Administration, Dam Safety Division, Annapolis, Maryland.
REGIONAL VICINITY MAP	See Appendix E, U.S.G.S. 7.5 minute quadrangle map showing dam site location.
CONSTRUCTION HISTORY	Design drawings were prepared by Rummel, Klepper and Kahl, Baltimore, Maryland. The dam was constructed by Campbell & Sons between June 1975 and September 1976. Exact construction dates were not available.
TYPICAL SECTIONS OF DAM	See Plate Nos. 1 and 3.
OUTLETS - PLAN	See Plate No. 1.
DETAILS	See Plate Nos. 3, 4, 5, and 6.
CONSTRAINTS	None.
DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	None.

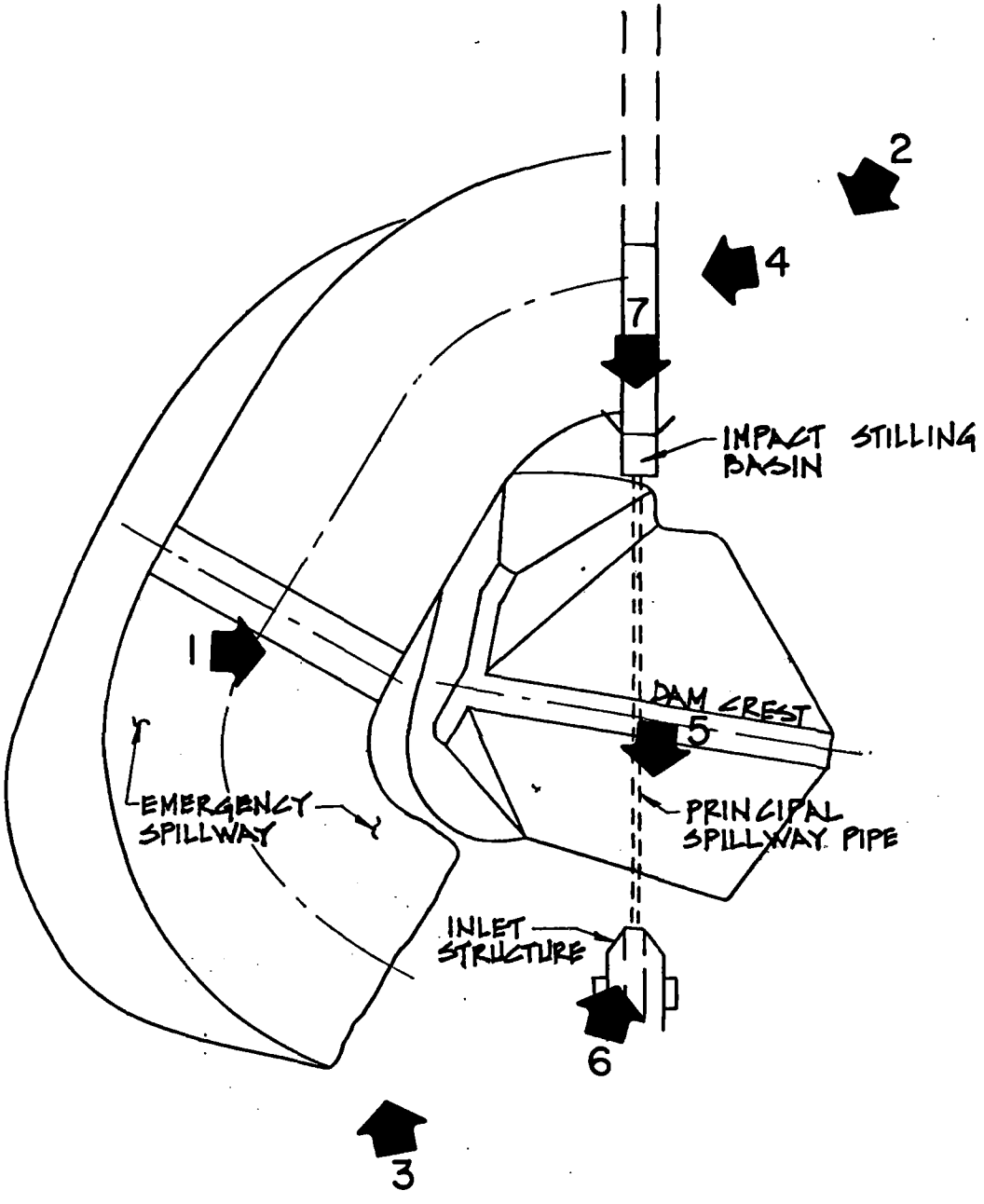
ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Hydrologic and hydraulic computations performed by Rummel, Klepper and Kahl were available for review. Dam stability and seepage studies were not available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	See Plate Nos. 1 and 2.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN	See Plate Nos. 1 and 6.
SECTIONS	See Plate No. 3.
DETAILS	See Plate Nos. 1, 3, and 6.
OPERATING EQUIPMENT PLANS & DETAILS	None.
SPECIFICATIONS	None.
MISCELLANEOUS	N/A

APPENDIX C

PHOTOGRAPHS



PHOTOGRAPH KEY MAP

DATE: AUG. 8, 1980	NATIONAL DAM INSPECTION PROGRAM	U.M.B.C. DAM SITE
SCALE: NONE		
DR: JLM CK: TED	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD.	
DWG. NO. C-1		

PHOTOGRAPH 1	Overview of upstream embankment slope and embankment-spillway abutment.
PHOTOGRAPH 2	Overview of downstream embankment slope, riprap protection and impact stilling basin. Note tree and woody shrub growth.
PHOTOGRAPH 3	View of emergency spillway approach channel.
PHOTOGRAPH 4	View of emergency spillway outlet channel.

1

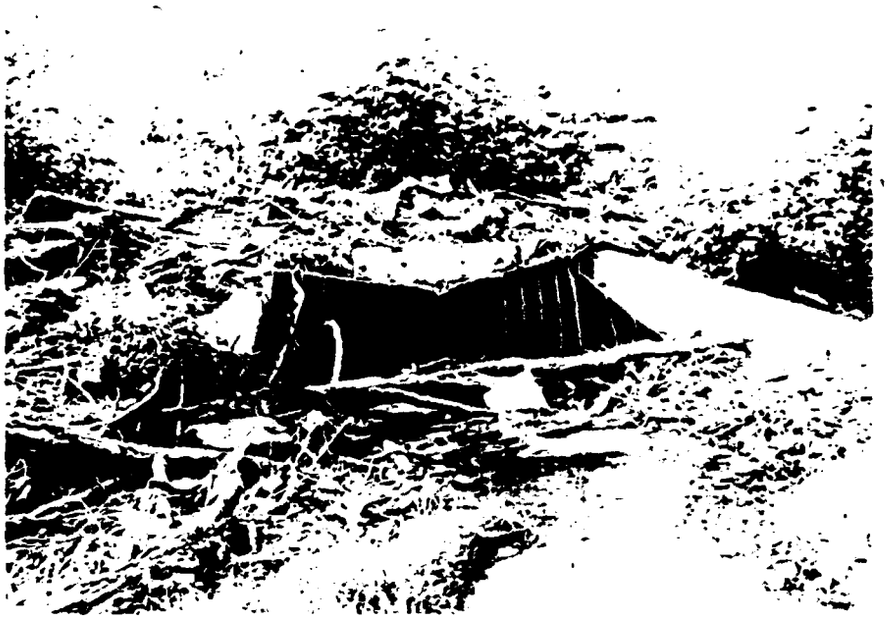
2

3

4

PHOTOGRAPH 5	Overview of impoundment basin. Note accumulated debris and sediment.
PHOTOGRAPH 6	Close-up view of principal spillway entrance structure and trash rack. Note damaged trash rack.
PHOTOGRAPH 7	Close-up view of impact stilling basin. Note sediment deposit and tree growth in exit channel.
PHOTOGRAPH 8	Downstream hazard.

5



6

7

8

APPENDIX D

HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Grassland (65%), urban development (20%), woodland (15%).

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): N/A

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): El. 178.0 (185.0 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: El. 178.0

ELEVATION TOP DAM: El. 175.0

EMERGENCY SPILLWAY

a. Elevation El. 166.5
b. Type Trapezodial Earth Channel
c. Width 150 ft.
d. Length 694 ft.
e. Location Left abutment
f. Number and Type of Gates None

OUTLET WORKS

a. Type 36 in. dia. R.C. pipe
b. Location 120 ft. left of right abutment
c. Entrance Invert El. 139.5
d. Exit Invert El. 136.9
e. Emergency Drawdown Facilities None

HYDROMETEOROLOGICAL GAGES

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE 11,700 cfs

U.M.B.C. DAM
HYDROLOGY REVIEW

Determine rainfall amount for PMF spillway design flood.

A. PMF rainfall for Baltimore County, Maryland

Approximately, 24 in./24 hr.

Rainfall obtained from Hydrometeorological Report No. 33. Based on 200 sq. mi. watershed.

B. Adjust rainfall for 6 hr. duration

Watershed area = 1.2 sq. mi.

Dam site located in Zone 6, therefore

24 in./24 hr. x 113% = 27.1 in./6 hr.

Adjustment factor obtained from Depth-Area-Duration Relationships, Hydrometeorological Report No. 33.

C. Adjust rainfall for drainage area.

Reduction factor = 0.8 (for watershed areas 10 sq. mi. or less)

Therefore, adjusted PMF rainfall =

0.8 x 27.1 in./6 hr. = 21.7 in./6 hr.

CHKD. BY..... DATE..... HERBERT RUN WATERSHED ..... JOB NO.....

..... HYDROLOGIC COMPUTATIONS ....

REFERENCES:

1. USDA SCS, ENGINEERING HANDBOOK, SECT 4 HYDROLOGY
2. WEATHER BUREAU TECHNICAL PAPER NO. 40
3. USGS QUAD. SHEET, BALT. WEST, MD. (RUNOFF
4. USDA SCS, NATIONAL ENG. HANDBOOK, SECT 4 HYDROLOG
5. USDA SCS, UD METHOD OF RESERVOIR FLOOD ROUTI

WATERSHED DATA

1. DRAINAGE AREA = 750 ACRES = 1.17 SQ MILES (HYDRO GRAPH

2. TIME OF CONCENTRATION

Δ ELEV. = 300' - 150' = 350'

LENGTH OF PATH = 3500

∴ USING NOMOGRAPH (FIG 3.15-3, REF 1)

T_c = .5 HOURS

3. RUNOFF CONDITION NO.:

ASSUME AMC II

4. GROUND COVER:

WOODS	15%	CN = 73
URBAN	20%	CN = 90
GRASS	65%	CN = 79

$$\text{WEIGHTED CN VALUE} = \frac{[.15(73) + .20(90) + .65(79)]\,75}{750}$$

$$= 80.2 \rightarrow \text{CN } 80$$

USE CN FOR AMC III = 91

DETERMINATION OF T_P

$T_P = .7\ T_C = .7(.5) = .35$ HRS

HYDROGRAPH DATA

STORM	RUNT RAINFALL(IN)	CN-AMC	RUNOFF Q (IN)	To (HOURS)	HYD FAMILY	COMP To/Tp	USED To/Tp
100YR 6HR.	5.2	91-III	4.2	5.5	1	15.7	16.0
PMP.	27.0	80-II	24.2	5.73	1	16.4	16.0

HYDROGRAPH COMPUTATION, 100 YR 6 HR (SEE SHEET 17)
(REF 1 TABLE 3.21

$$q_P = \frac{484A}{\text{REV } T_P} = \frac{484(1.17)}{.34} = 1670 \text{ CFS}$$

$Q_{qP} = 1670 \times 4.2 = 7000$ CFS

HYDROGRAPH COORDINATES — FAMILY 1, DIST. B

LINE	t/Tp	q/qp	t	q
1	.0	.000	0	0
2	.66	.001	.224	7
3	1.32	.006	.448	42
4	1.98	.015	.674	105
5	2.64	.027	.898	189
6	3.30	.037	1.120	259
7	3.96	.047	1.350	329
8	4.62	.062	1.57	434
9	5.28	.092	1.79	644
10	5.94	.223	2.02	1560
11	6.60	.309	2.24	2160
12	7.26	.243	2.47	1700
13	7.92	.171	2.67	1200
14	8.58	.124	2.92	868
15	9.24	.097	3.14	679
16	9.90	.081	3.37	567
17	10.56	.070	3.58	490
18	11.22	.061	3.82	472
19	11.88	.055	4.04	385

LINE	t/tp	qc/qp	t	q
20	12.54	.050	4.26	350
21	13.20	.047	4.48	329
22	13.86	.045	4.71	315
23	14.52	.044	4.94	308
24	15.18	.043	5.15	301
25	15.84	.040	5.38	280
26	16.50	.034	5.61	238
27	17.16	.020	5.83	140
28	17.82	.008	6.06	56
29	18.48	.004	6.27	28
30	19.14	.002	6.57	14
31	19.80	.001	6.73	7
32	20.46	.000	6.96	0

HYDROGRAPH COMPUTATION, PMP, 6 HR. (SEE SHEET 18)
(REF 1 TABLE 3.21-7)

$$q_p = \frac{484(1.17)}{.358} = 1580 \text{ CFS}$$

$$Q_{qp} = 1580 \times 24.2 = 38{,}200 \text{ CFS}$$

HYDROGRAPH COORDINATES — FAMILY 1 DIST B

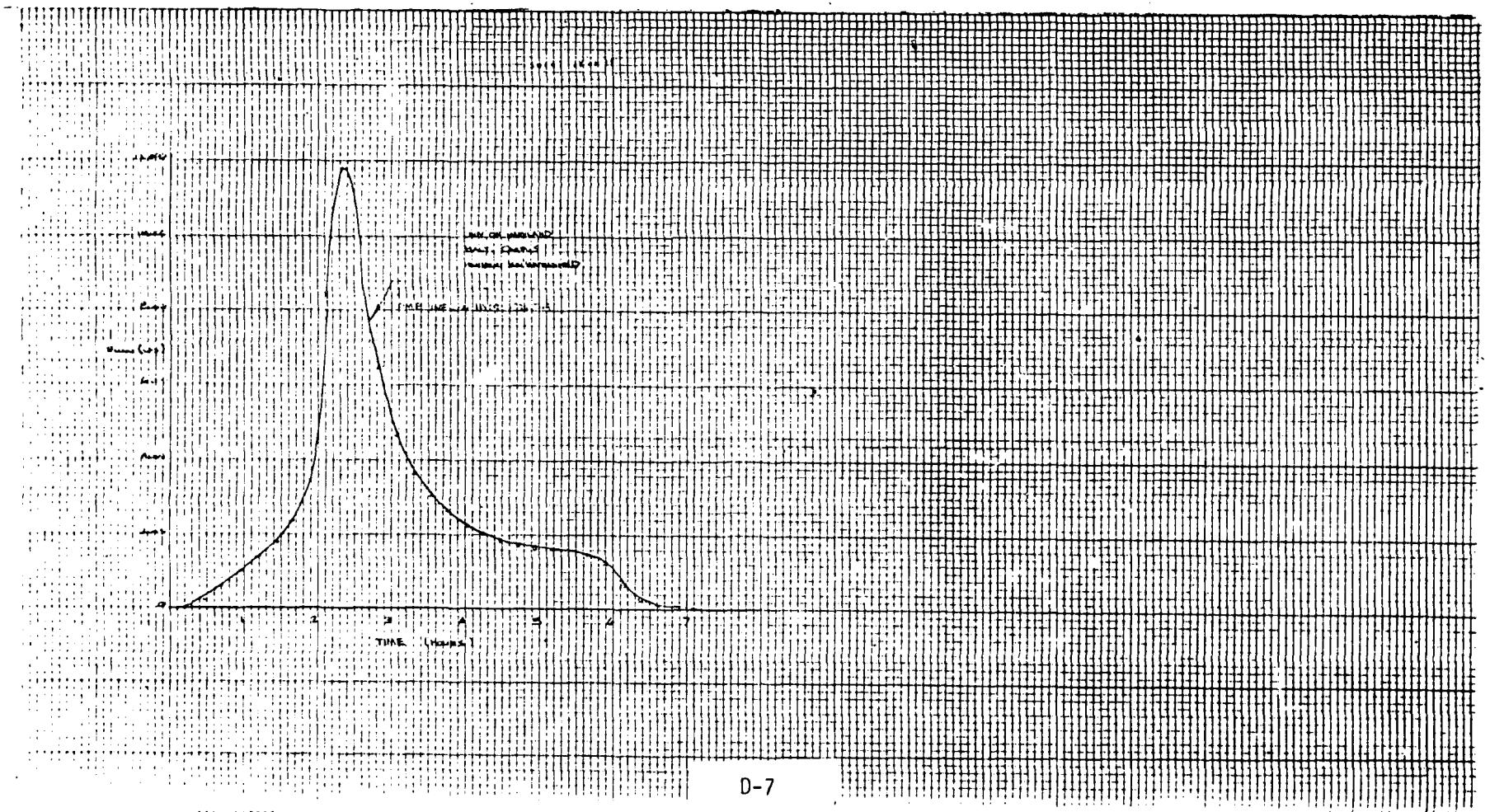
LINE	t/Tp	qc/qp	t	q
1	0	0	0	0
2	.66	.001	.236	38.2
3	1.32	.006	.47	229.2
4	1.98	.015	.63	573.0
5	2.64	.027	.945	1030
6	3.30	.037	1.18	1415
7	3.96	.047	1.42	1800
8	4.62	.062	1.65	2370
9	5.28	.092	1.89	3520
10	5.94	.223	2.12	8500
11	6.60	.309	2.36	11800
12	7.26	.243	2.60	9300
13	7.92	.171	2.83	6530
14	8.58	.124	3.06	4740
15	9.24	.097	3.30	3700

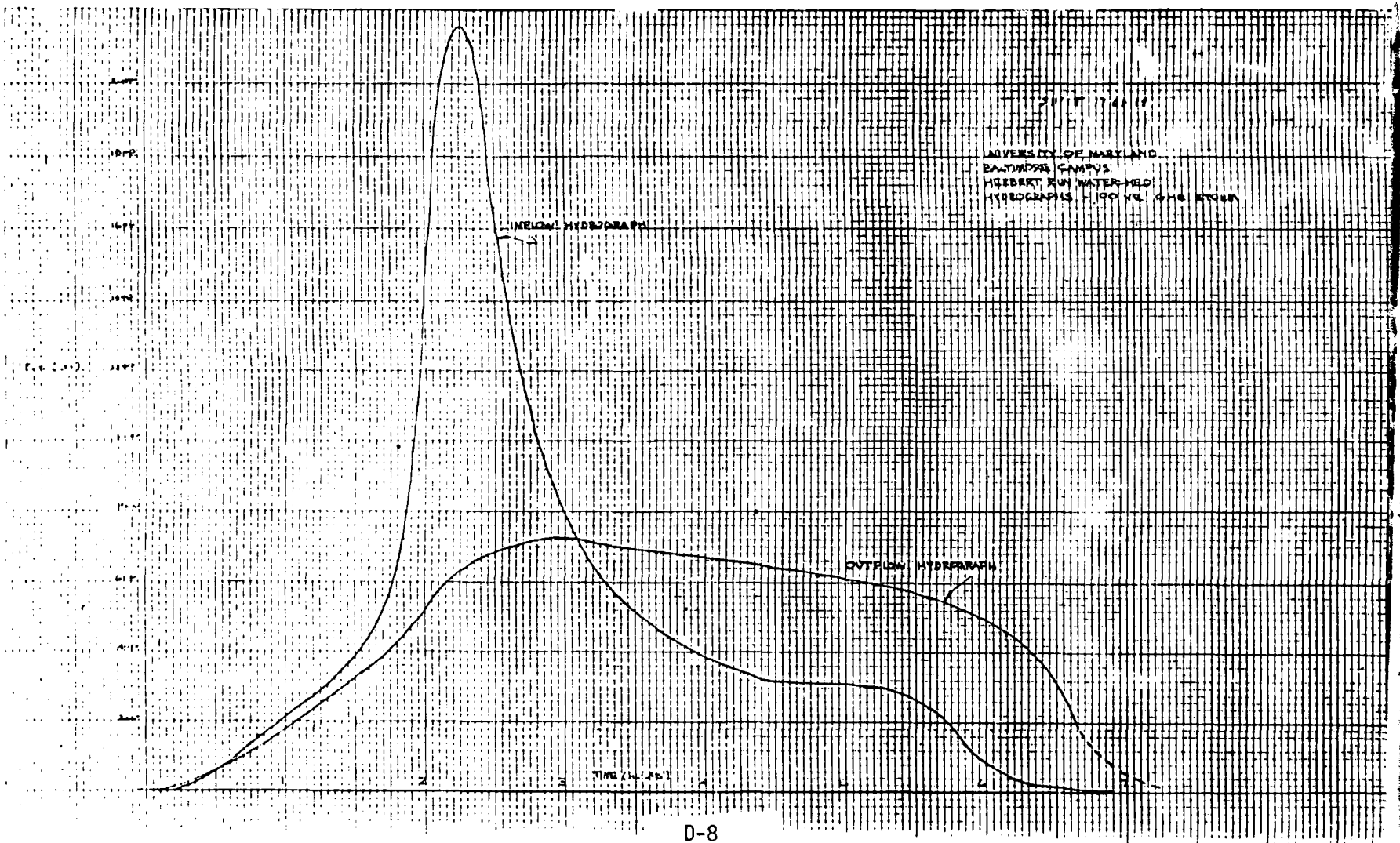
BY ... DATE ... SUBJECT UNIV. OF MARYLAND, P.A. ... SHEET NO. 4 OF 1

CHKD. BY ... DATE ... HERBERT RUN WATERSHED ... JOB NO. ...

... HYDROLOGIC COMPUTATIONS ...

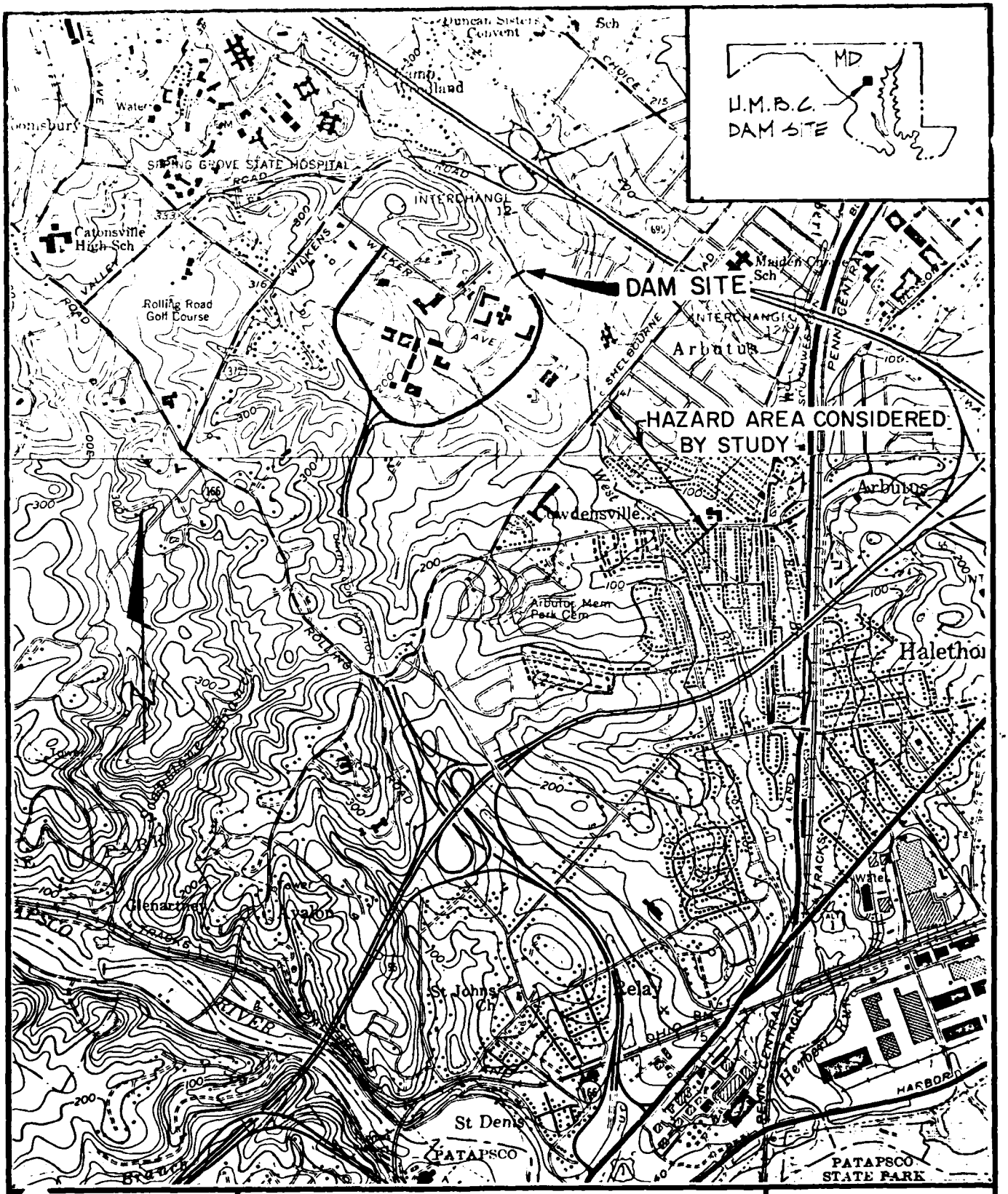
LINE	t/tp	q/qp	t	q
16	9.90	.081	3.54	3100
17	10.56	.070	3.78	2670
18	11.22	.061	4.02	2330
19	11.88	.055	4.24	2100
20	12.54	.050	4.48	1910
21	13.20	.047	4.72	1795
22	13.86	.045	4.95	1720
23	14.52	.044	5.20	1680
24	15.18	.043	5.42	1640
25	15.84	.040	5.66	1530
26	16.50	.034	5.90	1300
27	17.16	.020	6.12	765
28	17.82	.008	6.37	306
29	18.48	.004	6.59	153
30	19.14	.002	6.84	76.5
31	19.80	.001	7.06	38.2
32	20.46	0	7.30	0


TIME (Hours)

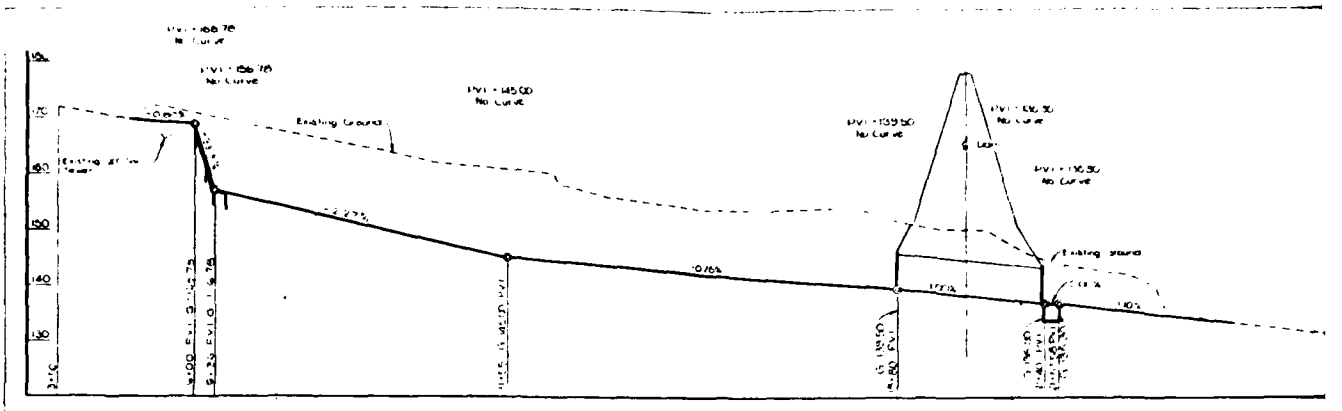

UNIVERSITY OF MARYLAND
BALTIMORE CAMPUS
HERBERT RUN WATER YIELD
INFLOW HYDROGRAPH
OUTFLOW HYDROGRAPH

APPENDIX E

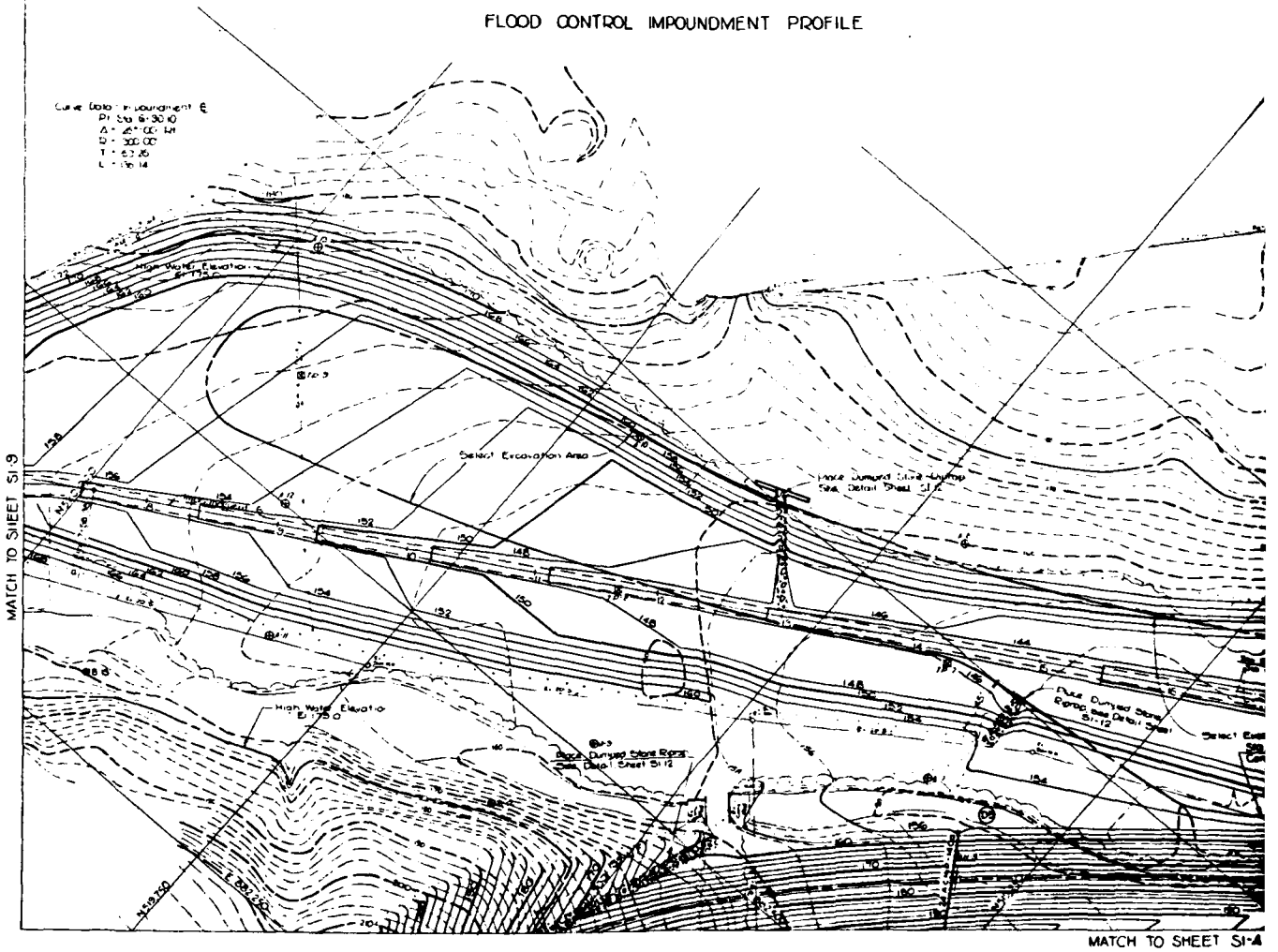
LOCATION PLAN AND PLATES



DATE: AUG. 8, 1980	NATIONAL DAM INSPECTION PROGRAM	LOCATION PLAN OF U.M.B.C. DAM SITE
SCALE: 1:24000		
DR: JLM CK: TED	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD.	
DWG. NO. E-1		



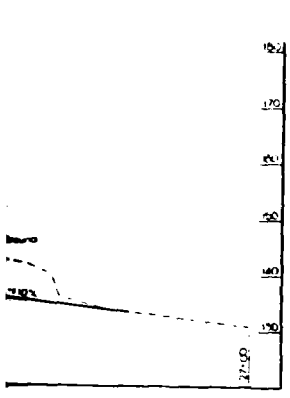
FLOOD CONTROL IMPOUNDMENT PROFILE

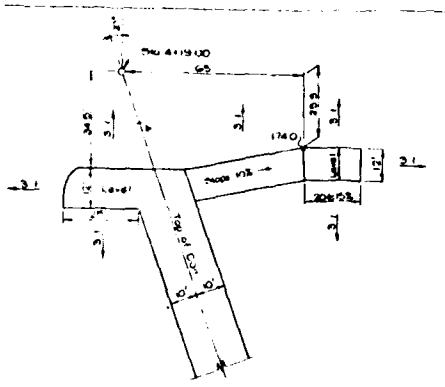


MATCH TO SHEET SI-9

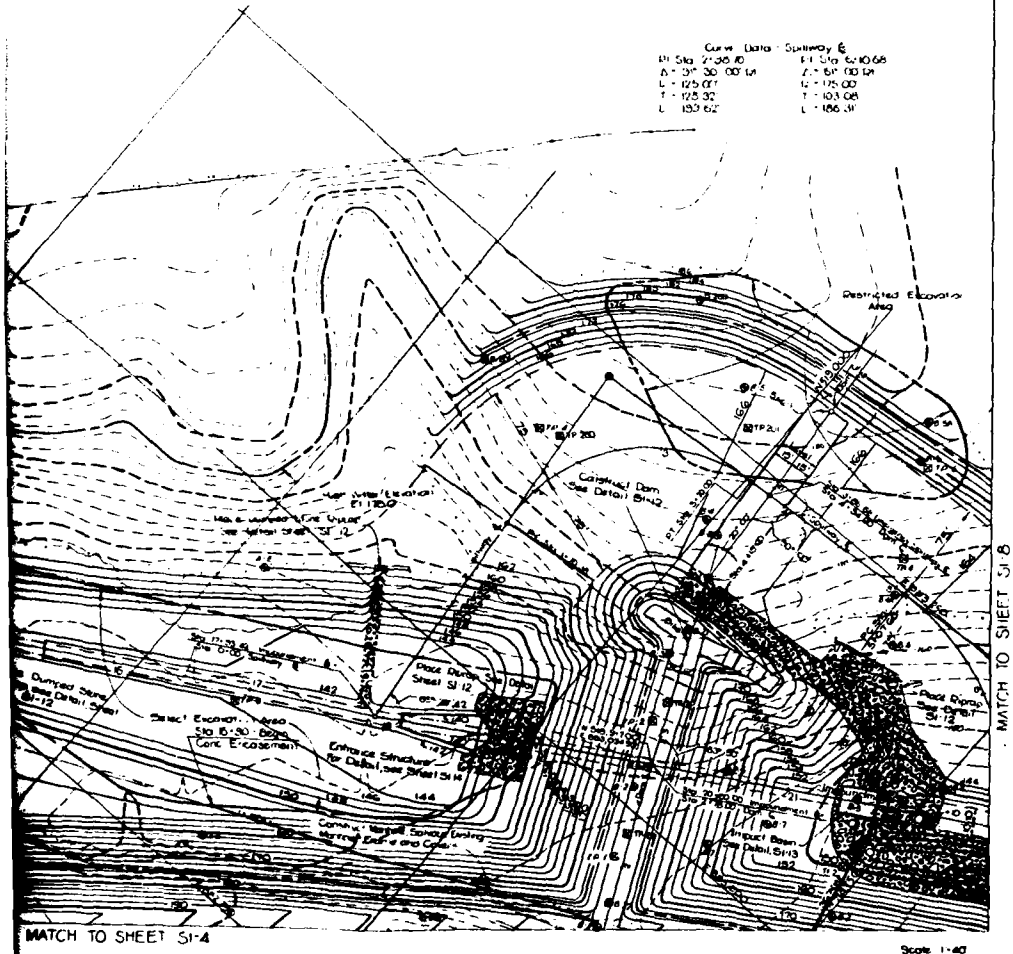
MATCH TO SHEET SI-4

RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
BALTIMORE, MARYLAND





DIKE DETAIL



Scale 1"=40'

PART PLAN

CAMPUS LOOP ROAD

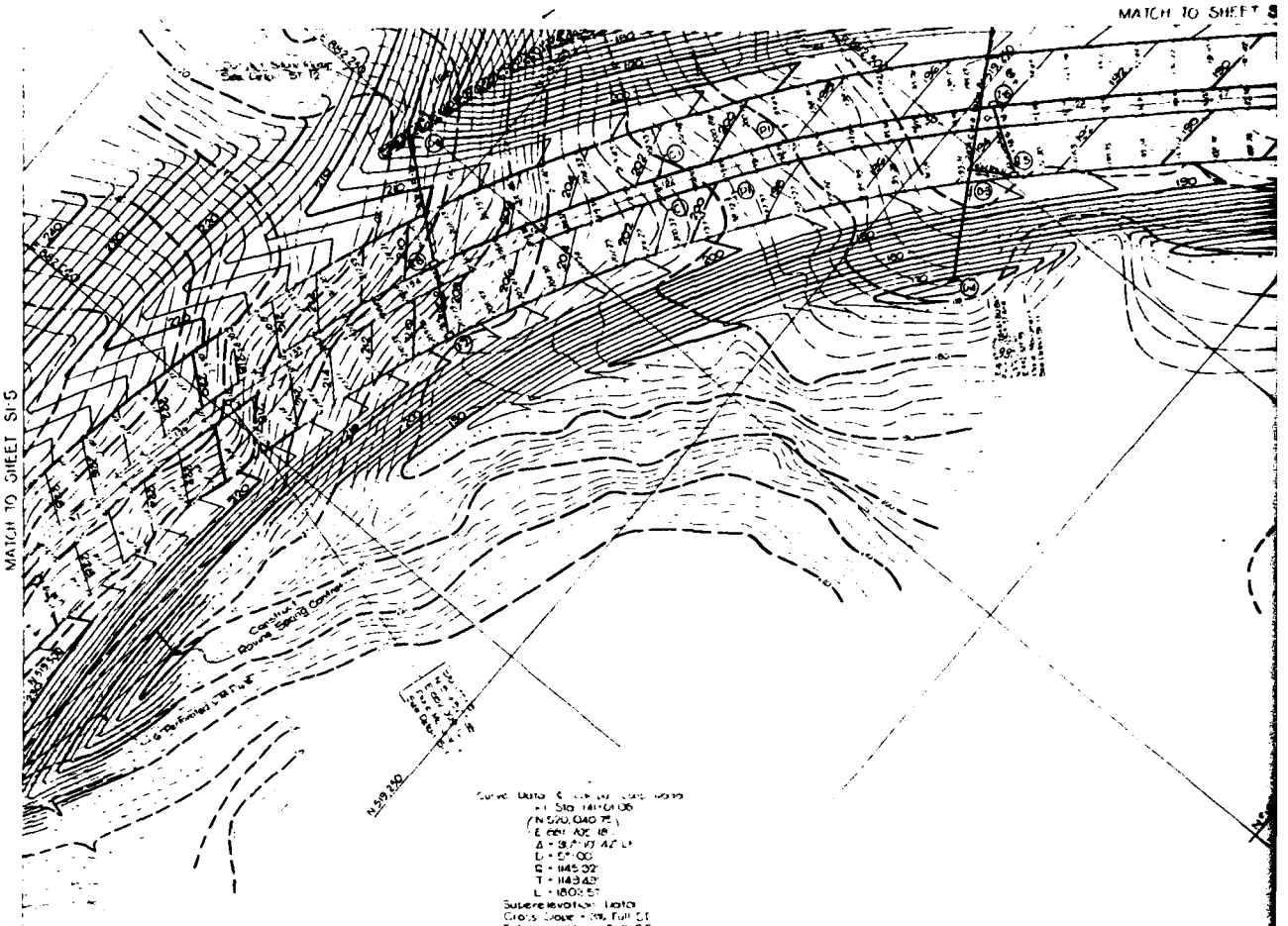
UNIVERSITY OF MARYLAND
BALTIMORE COUNTY, MD

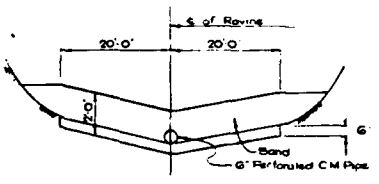
NO	DATE	REVISIONS

JOB NO 00-00-13-302
& KAU 6-714 EST
DATE JUNE 1971

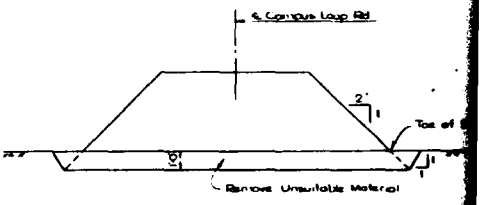
DWG NO
SI-7
OF 15 SHEETS

PLATE NO. 1



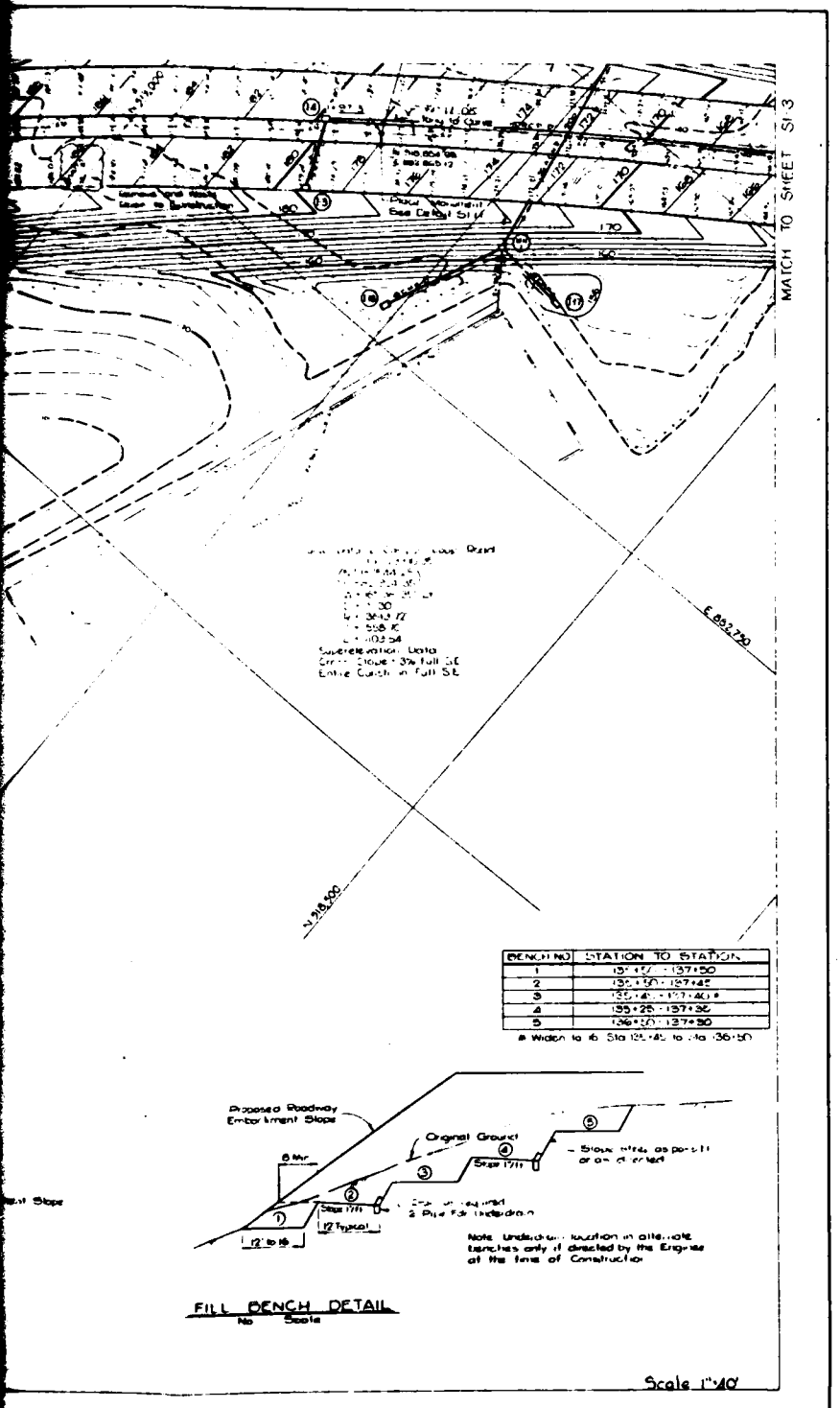


RAVINE SPRING CONTROL
No Scale



UNDERCUTTING - STA 124+30 TO 127+40
No Scale

RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
BALTIMORE, MARYLAND



BENCH NO	STATION TO STATION
1	135+45 - 137+50
2	135+50 - 137+45
3	135+45 - 137+40 *
4	135+25 - 137+35
5	136+30 - 137+30

* Widen to 16' Sta 135+45 to Sta 136+50

FILL BENCH DETAIL
No Scale

Scale 1"=40'

PART PLAN

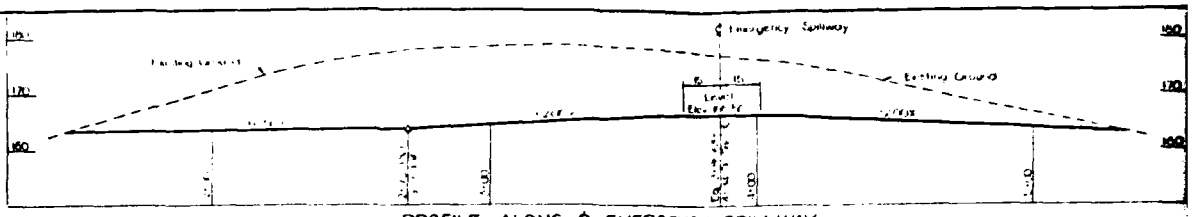
NO	DATE	REVISIONS

CAMPUS LOOP ROAD

UNIVERSITY OF MARYLAND
BALTIMORE COUNTY, MD

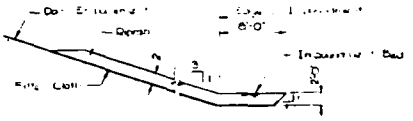
JOB NO 60-013-30
S. RTE 6-74 EXT
DATE JUNE 1974
SHT NO
SI-4
OF 15 SHEETS

PLATE NO. 2



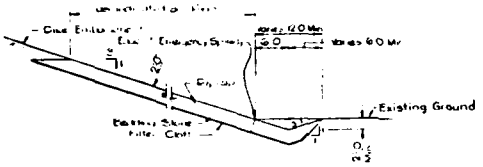
PROFILE ALONG ℄ EMERGENCY SPILLWAY

Scale: Horiz. 1" = 50'
Vert. 1" = 10'



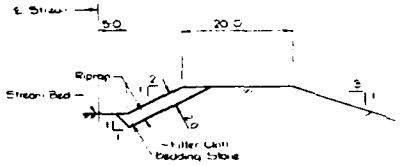
RIPRAP ALONG DAM SLOPE &
EMERGENCY SPILLWAY - STA 3+71-4+86

No Scale



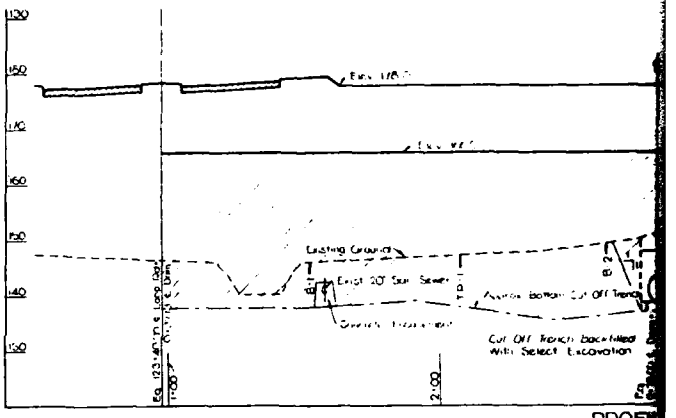
RIPRAP ALONG EMERGENCY SPILLWAY

No Scale

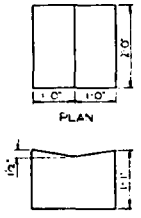


RIPRAP ALONG STREAM CHANNEL AT STA. 5+50

No Scale



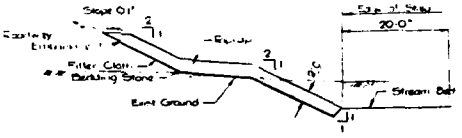
PROF



SUGGESTED SUPPORT BLOCK

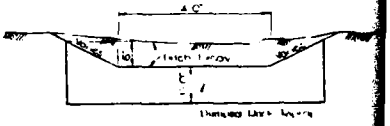
No Scale

Note
Sufficient Blocks Shall Be Provided To Support The Pipe To The Required Line And Grade. The Contractor Shall Determine The Number Of Blocks Required



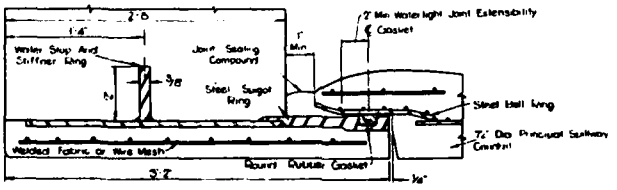
RIPRAP ALONG ROADWAY SLOPE

No Scale



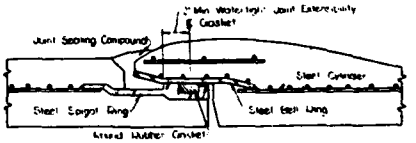
DUMPED ROCK RIP RAP DETAIL

No Scale



DETAIL OF SPIGOT WALL FITTING

No Scale



DETAIL OF PIPE JOINT

No Scale

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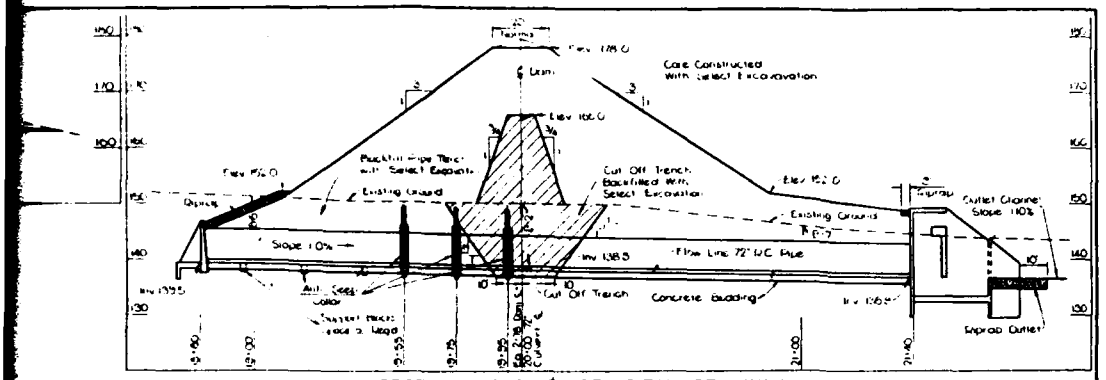
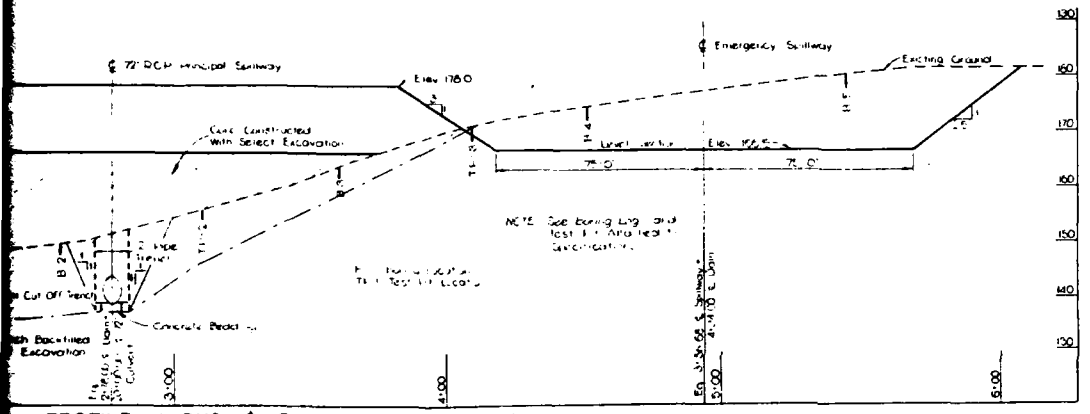
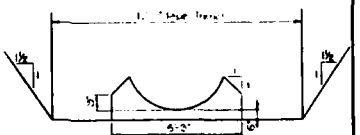
CONSULTING ENGINEERS
BALTIMORE, MARYLAND



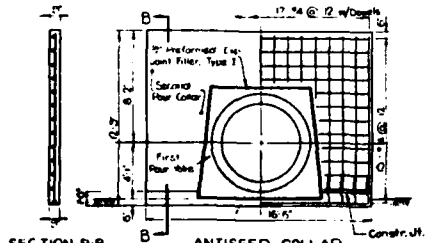
PROFILE ALONG ℄ PRINCIPAL SPILLWAY



PROFILE ALONG ℄ DAM & CUT-OFF TRENCH

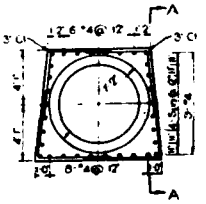


PRINCIPAL SPILLWAY CONCRETE BEDDING

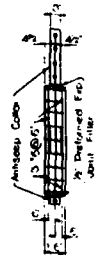


SECTION B-B

ANTISEEP COLLAR



ANTISEEP COLLAR YOKE DETAIL

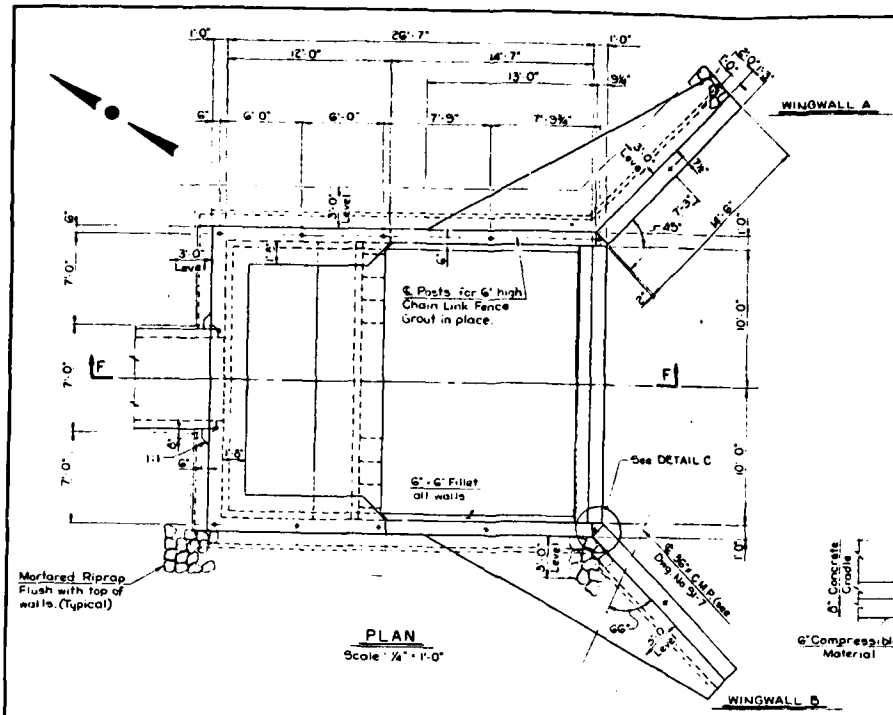


SECTION A-A

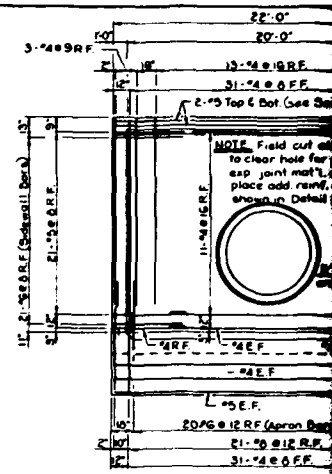
FLOOD CONTROL DETAIL SHEET

KAHL			REVISIONS	CAMPUS LOOP ROAD	JOB NO 00-10-13-310 & RAU 6-74 EXT
				UNIVERSITY OF MARYLAND BALTIMORE COUNTY, MD.	DATE JUNE 1974
					DWG NO SI-12
					OF 13 SHEETS

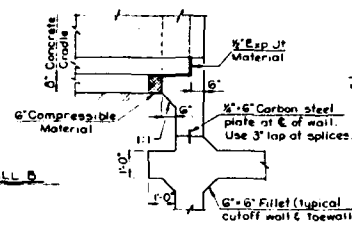
PLATE NO. 3

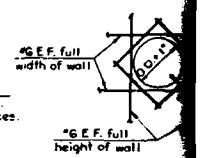


PLAN
Scale: 1/4" = 1'-0"

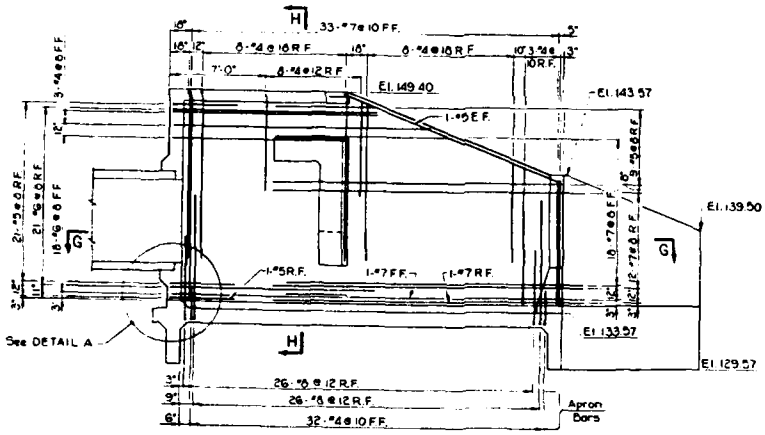


ELEVATION - HEAD
Scale: 1/4" = 1'-0"



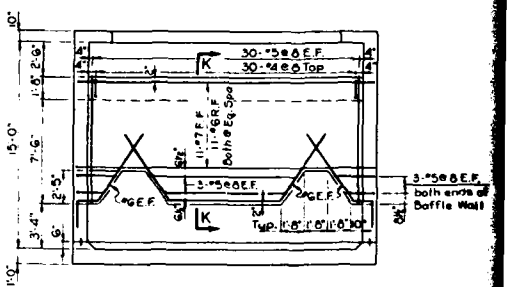


DETAIL
Not to Scale

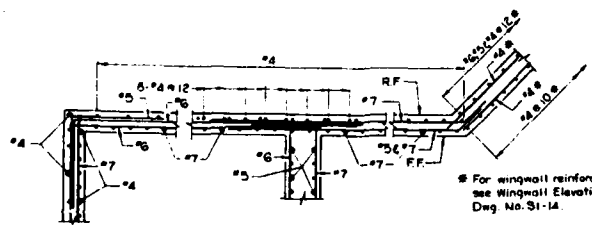


SECTION F-F
Scale: 1/4" = 1'-0"

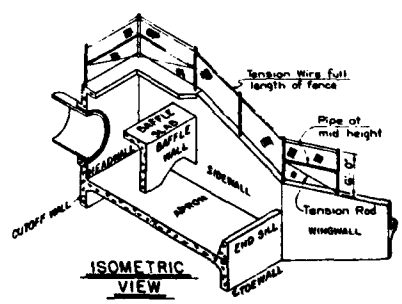
DETAIL A
Scale: 1/2" = 1'-0"



ELEVATION - BAFFLE WALL
Scale: 1/4" = 1'-0"

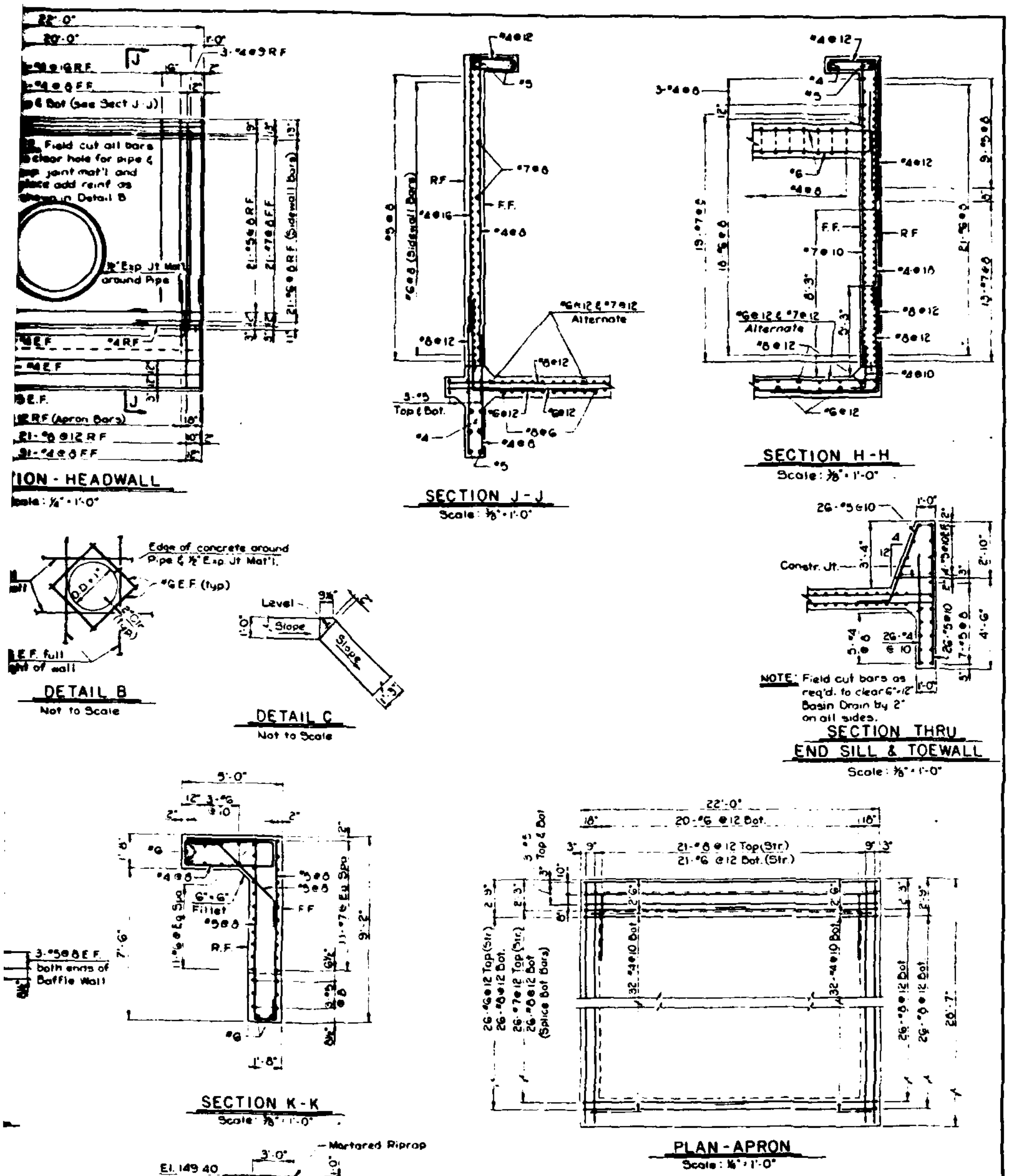


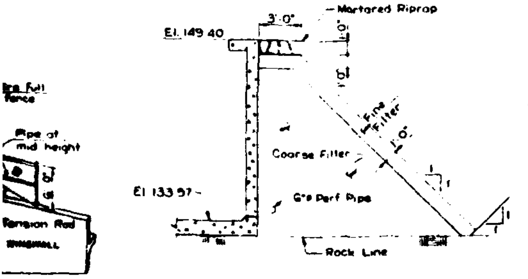
SECTION G-G
Scale: 3/8" = 1'-0"



ISOMETRIC VIEW
Not to Scale

RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
BALTIMORE, MARYLAND





SECTION THROUGH DRAIN & FILTER
Not to Scale

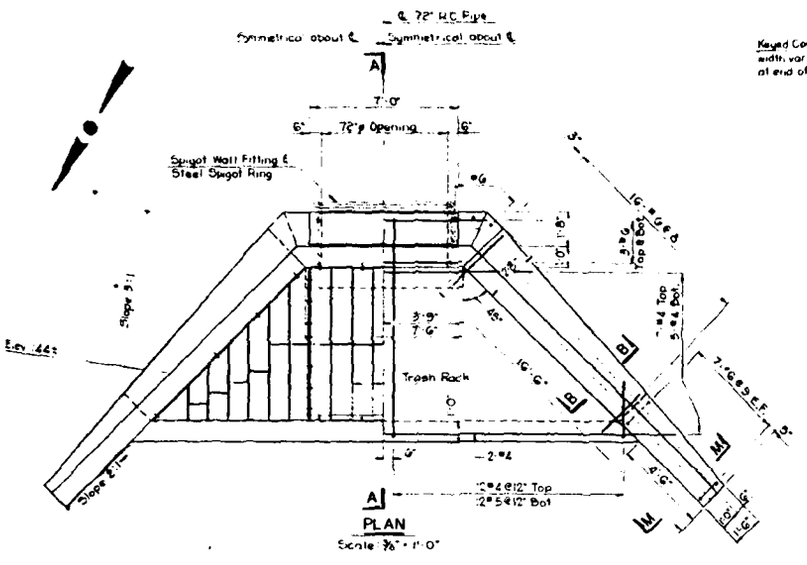
STRUCTURE NOTES

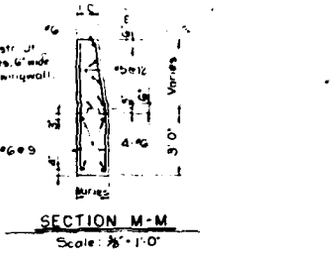
- All Concrete shall have a 28 day min. ultimate strength of 3000 psi. See Specifications.
- Reinforcement Steel shall conform to requirements of A.S.T.M. Specification A-15, as amended to date, intermediate grade. Deformations of reinforcing steel to be in accordance with A.S.T.M. Specification A-305, as amended to date.
- 2" concrete cover shall be provided on all reinforcement bars except where noted otherwise.
- Contractor shall provide all necessary support bars, hi-chairs etc. to support reinforcement in accordance with A.C.I. Standards.
- All bar splices shall be 24 bar diameters except where noted otherwise.
- Chamfer all exposed concrete edges 1" x 1".
- No backfilling shall be done against Impact Basin sidewalls until baffle slab & wall are in place and capable of resisting design stresses.
- All excavated areas shall be kept dry until backfill has been placed.
- All Structural Steel work shall be A.S.T.M. A-36 Designation unless otherwise shown or specified.

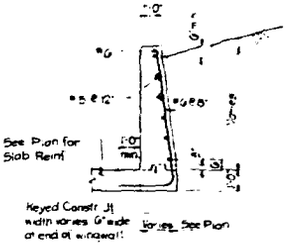
IMPACT BASIN FLOOD CONTROL DETAIL SHEET

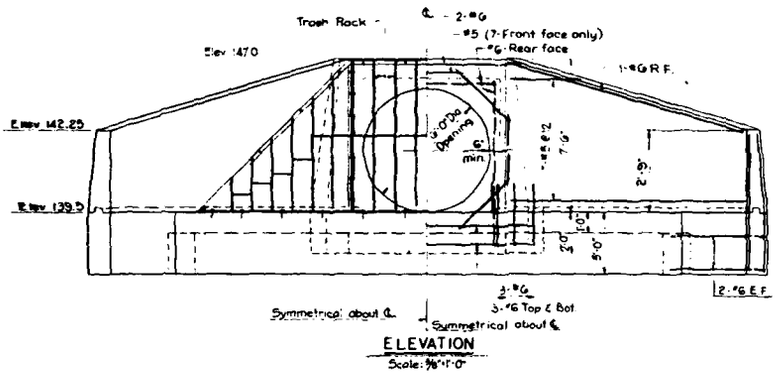
NO	DATE	REVISIONS		
			CAMPUS LOOP ROAD	JOB NO. CO 10/13-310 & XAU 6-714 EXT DATE JUNE 1974
			UNIVERSITY OF MARYLAND BALTIMORE COUNTY, MD	DWG NO SI - 13 OF 15 SHEETS

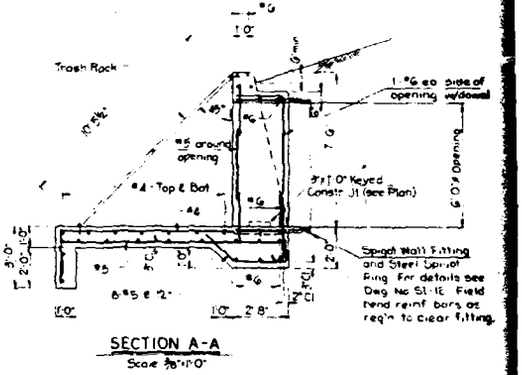
PLATE NO. 4

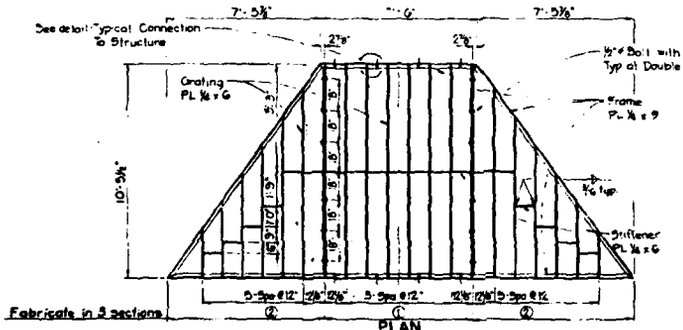


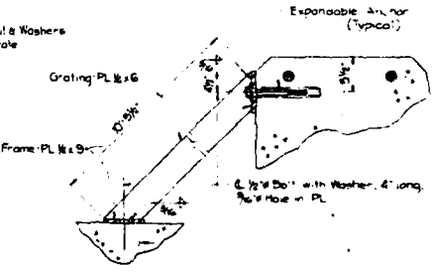






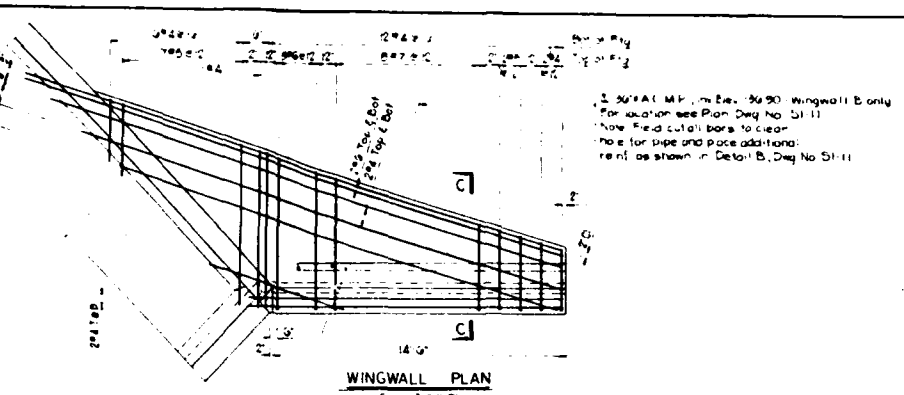




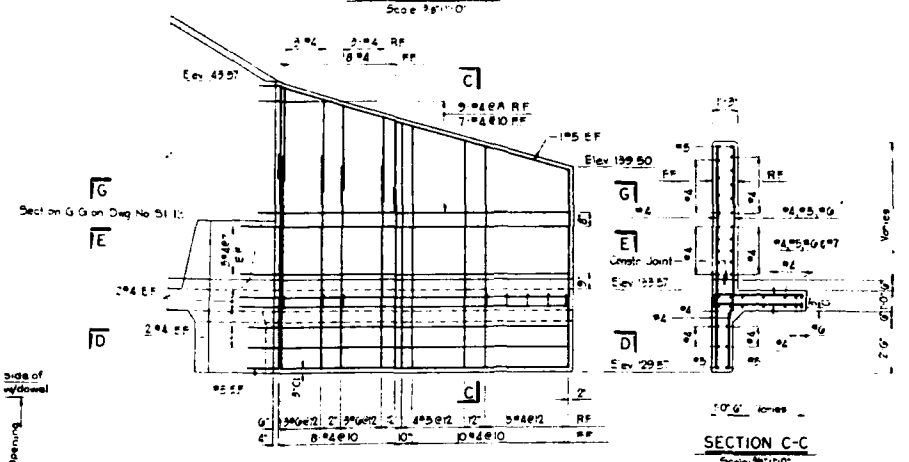


DETAILS OF ENTRANCE STRUCTURE

RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
BALTIMORE, MARYLAND

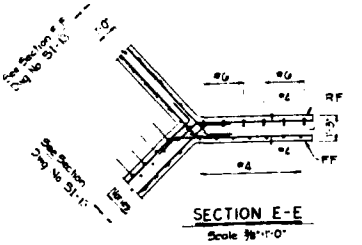


WINGWALL PLAN

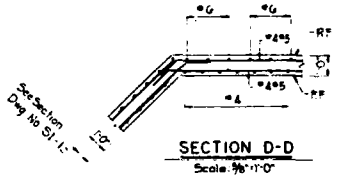


WINGWALL ELEVATION

SECTION C-C



SECTION E-E



SECTION D-D

WINGWALL DETAILS - IMPACT BASIN

FLOOD CONTROL DETAIL SHEET

NO.	DATE	REVISIONS

CAMPUS LOOP ROAD

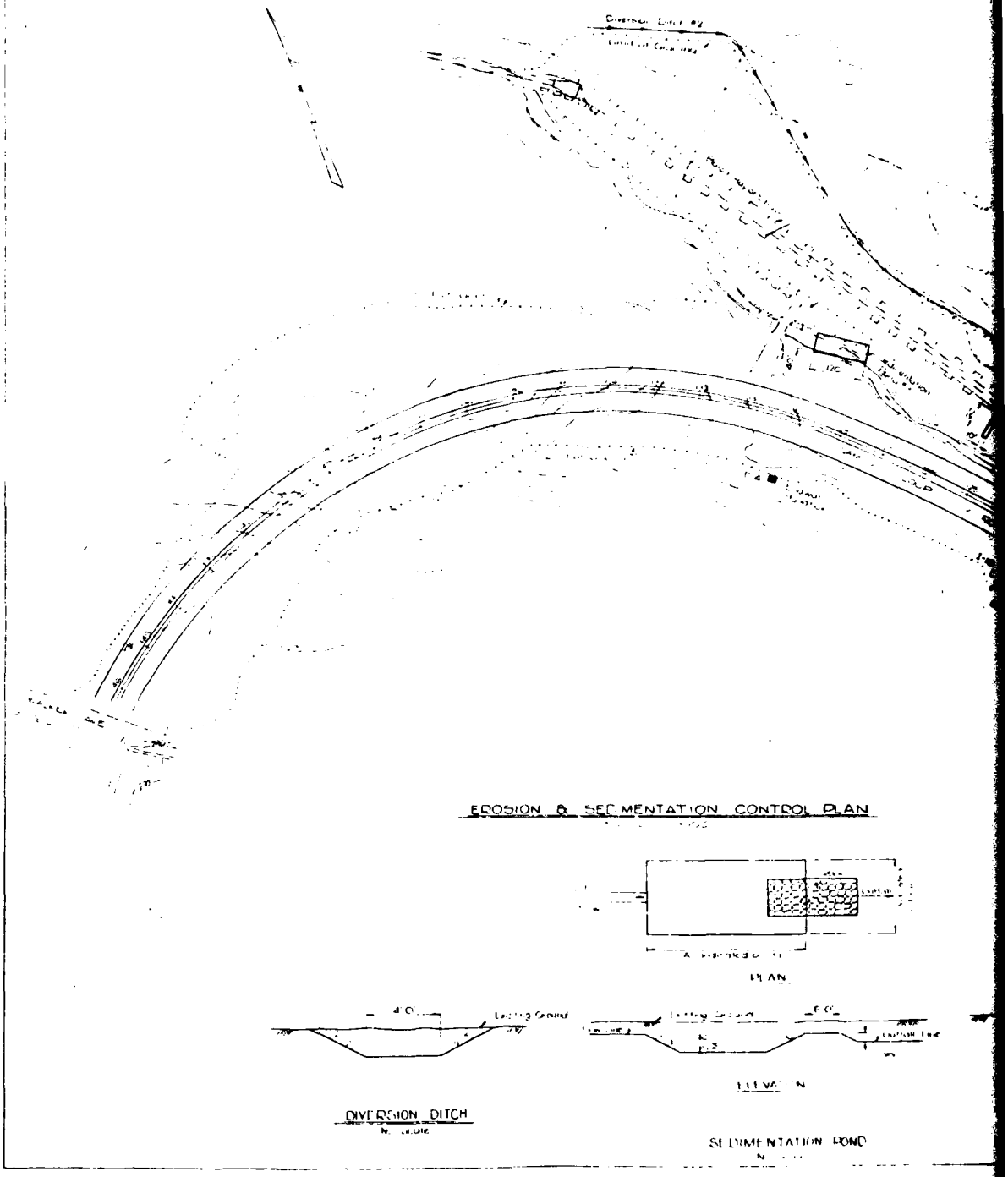
UNIVERSITY OF MARYLAND
BALTIMORE COUNTY, MD

DATE JUNE 1974

SI-14

OF 15 SHEETS

PLATE NO. 5



EROSION & SEDIMENTATION CONTROL PLAN

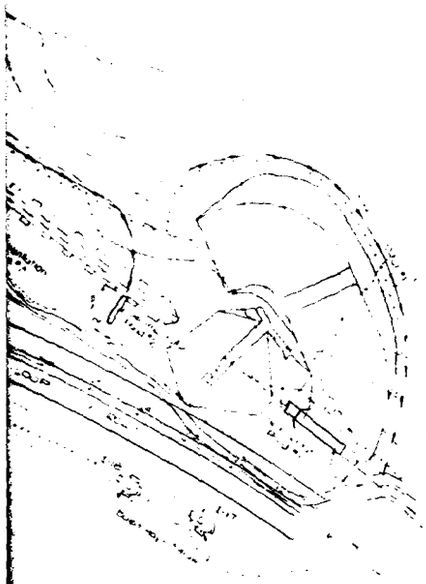
PLAN

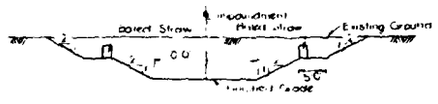
ELEVATION

DIVERSION DITCH

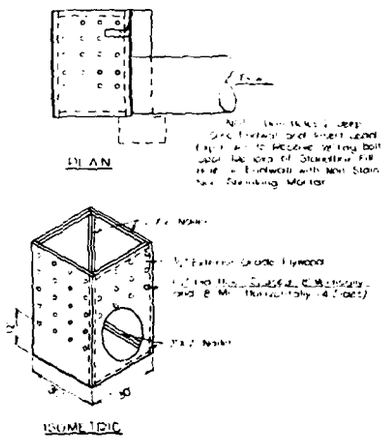
SEDIMENTATION POND

		RUMMEL, KLEPPER & KAHL CONSULTING ENGINEERS BALTIMORE, MARYLAND





INITIAL STREAM CHANNEL EXCAVATION



PLAN

ISOMETRIC

ENDWALL STANDBOX

EROSION & SEDIMENTATION CONTROL PLAN

KAHL	NO.	DATE	REVISIONS	CAMPUS LOOP ROAD	JOB NO. 00-10-73-345 & 350-6-714 EET
				UNIVERSITY OF MARYLAND	DATE JUNE 1974
				BALTIMORE COUNTY, MD	DWG NO. SI-15
					OF 15 SHEETS

PLATE NO. 6

APPENDIX F

REGIONAL GEOLOGY

U.M.B.C. DAM
NDI ID NO. MD 34
REGIONAL GEOLOGY

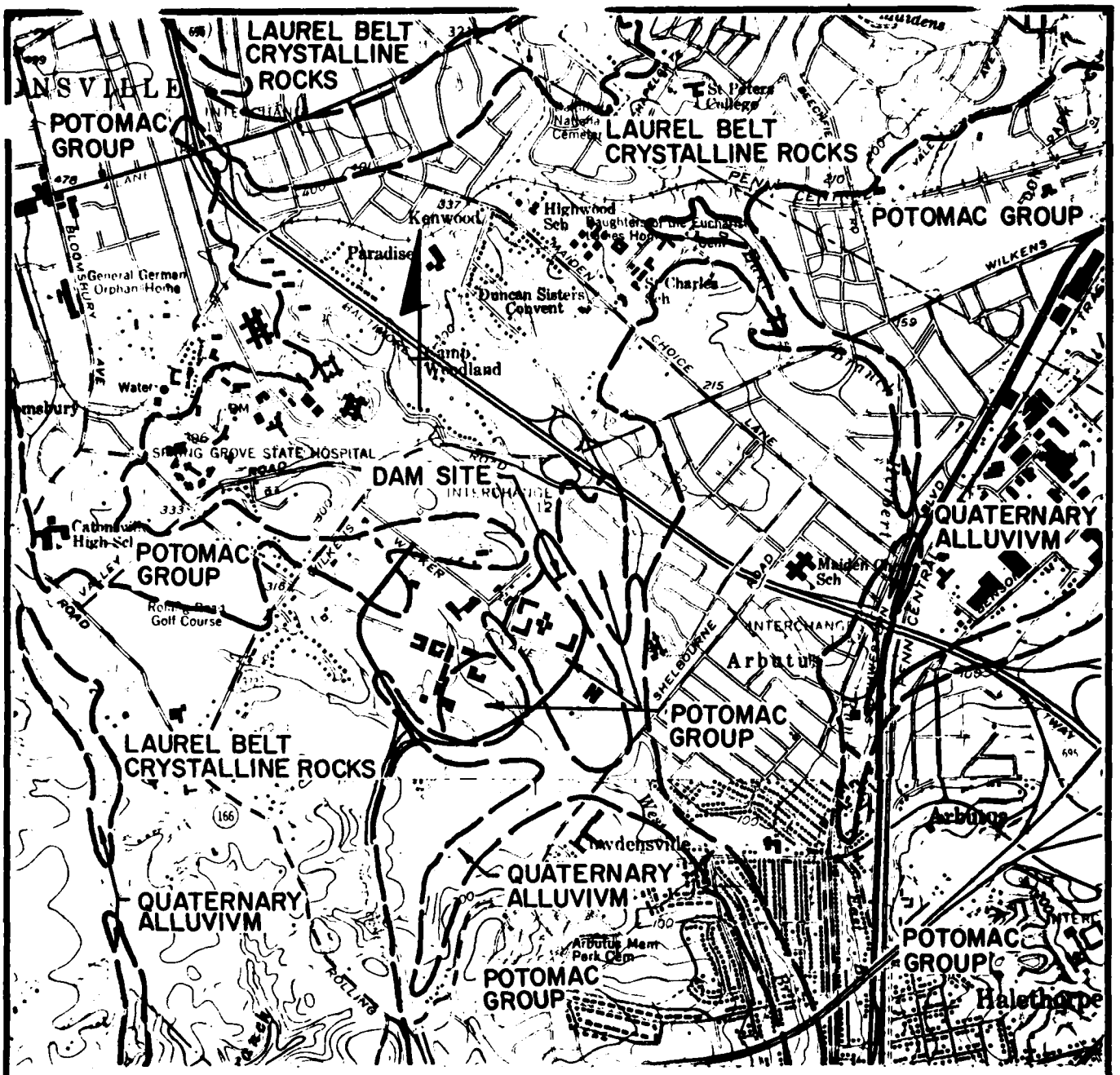
The U.M.B.C. Dam is located approximately one mile southwest of the Baltimore city limit in Catonsville, Maryland. The dam is situated on the eastern edge of the Fall Line Zone.

In generaal, the Laurel Belt crystalline rocks of Cambrian Age lie to the west of the U.M.B.C. campus, and the Potomac Group Sediments, of Lower Cretaceous Age, lie to the east. These rock and soil formations are members of the Upland Piedmont and Coastal Plain Provinces, respectively.

The dam was probably constructed in sandy alluvium of Quaternary Age, transported by the west branch of Herbert Run. The Patuxent Formation of Lower Cretaceous Age underlies these alluvium deposits, and consists predominately of sand, gravel and clay.

References

Crowley, William P.; Reinhardt, Juergen; and Cleaves, Emery T.; Geologic Map of Baltimore County and City; State of Maryland Geological Survey, 1976.



BALTIMORE WEST & RELAY QUADRANGLES BALTIMORE COUNTY & CITY, MARYLAND

SCALE: 0 — 1/2 MILE 1:24000

CONTOUR INTERVAL 20FT. DATUM IS MEAN SEA LEVEL

— — — INFERRED GROUP & FORMATION CONTACTS

DATA OBTAINED FROM MARYLAND GEOLOGICAL SURVEY'S GEOLOGIC MAP OF BALTIMORE COUNTY AND CITY, 1976

DATE: AUG. 8, 1980		NATIONAL DAM INSPECTION PROGRAM	SITE GEOLOGY OF U.M.B.C. DAM
SCALE: AS SHOWN			
DR: JLM	CK: GRG	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD.	
DWG. NO.	F-2		